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MARCH 27, 1959

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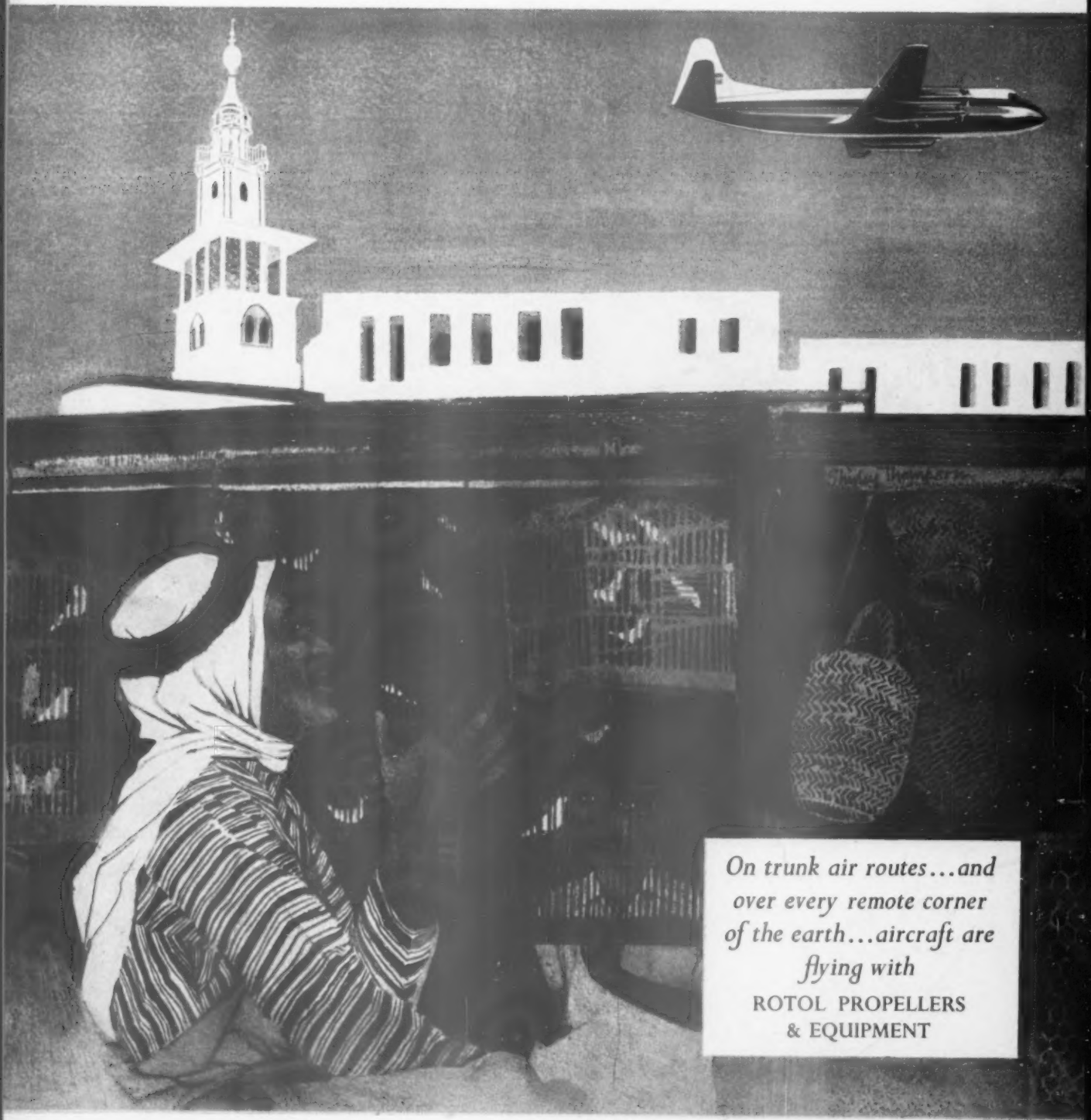

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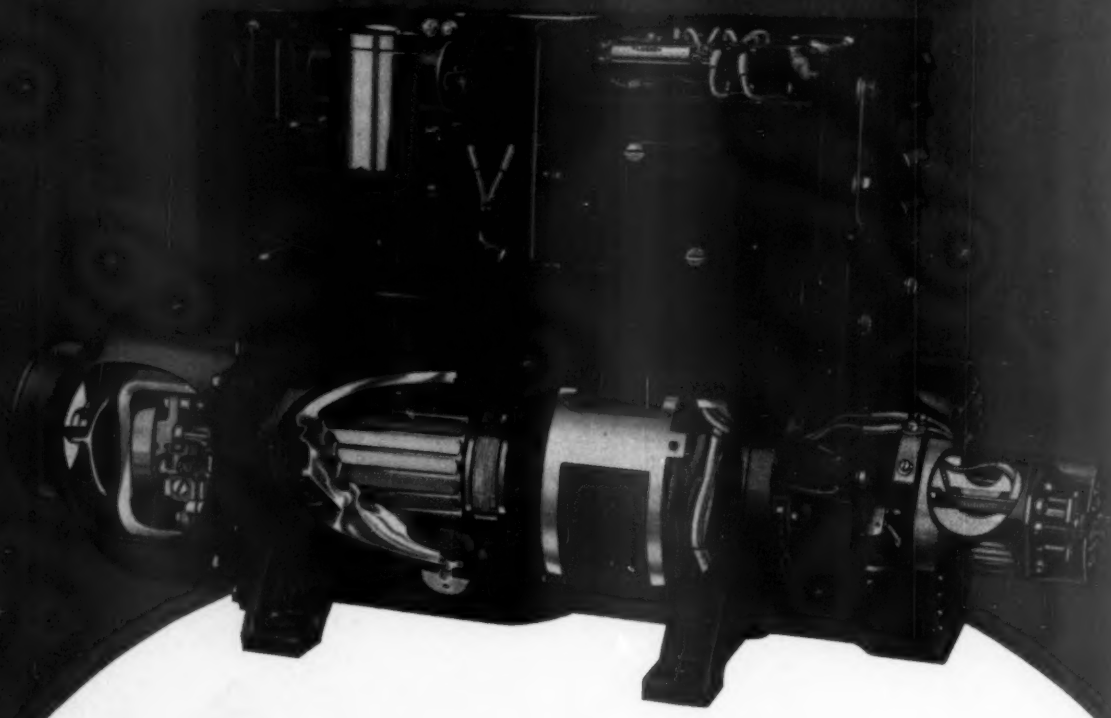

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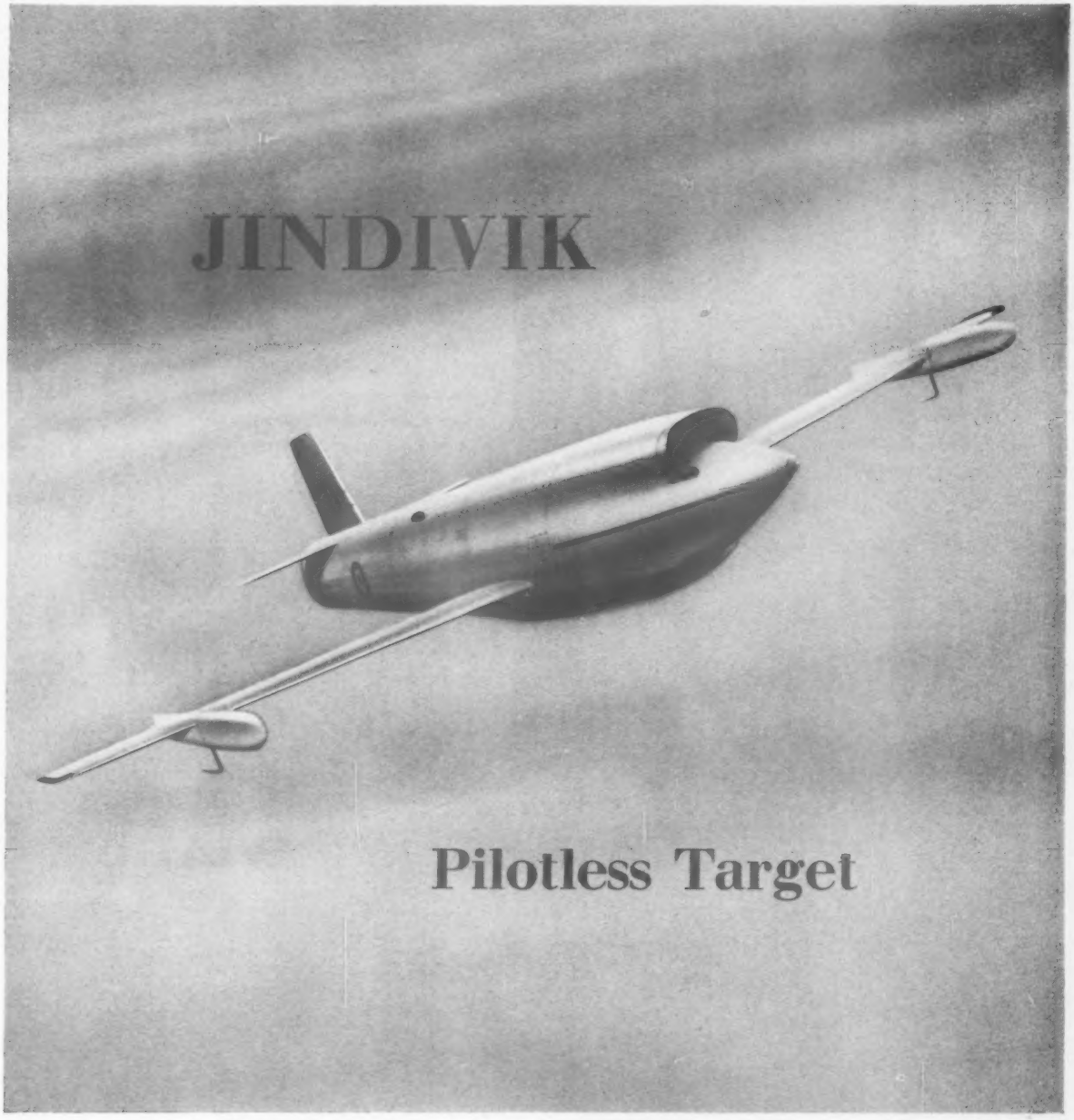

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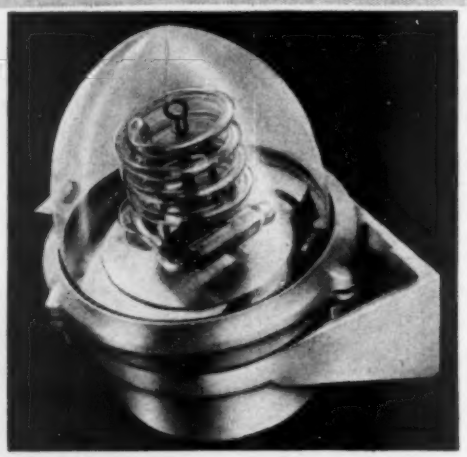

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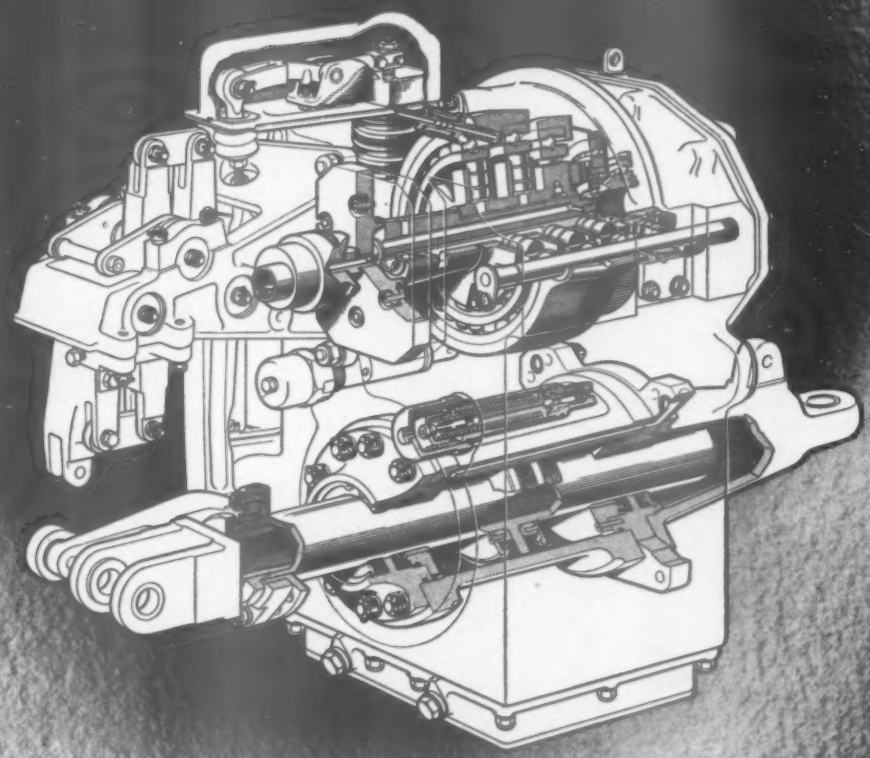

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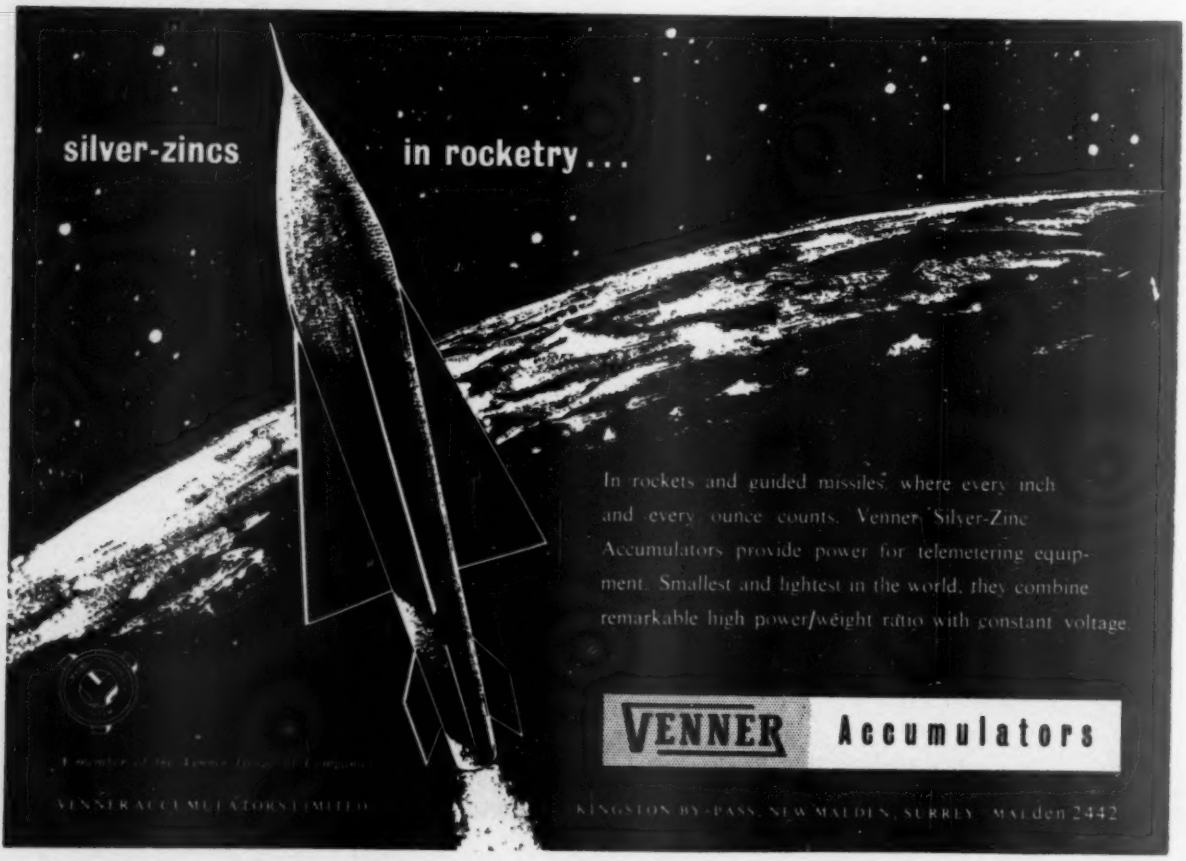
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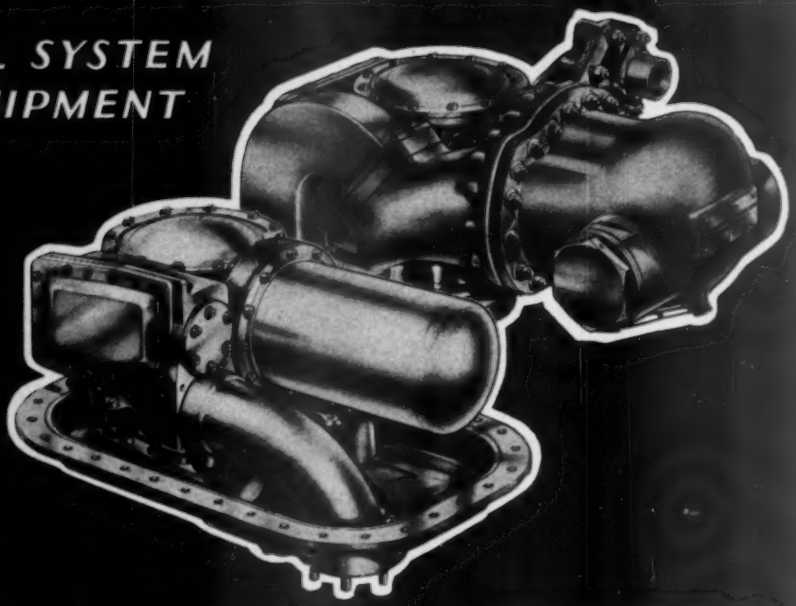

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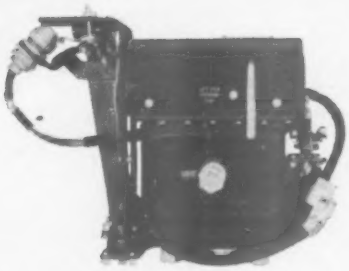

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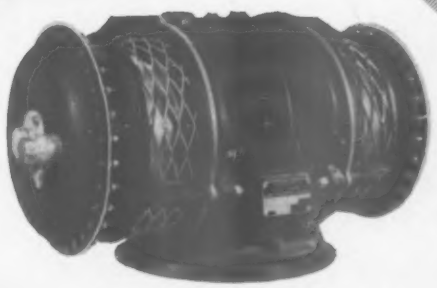

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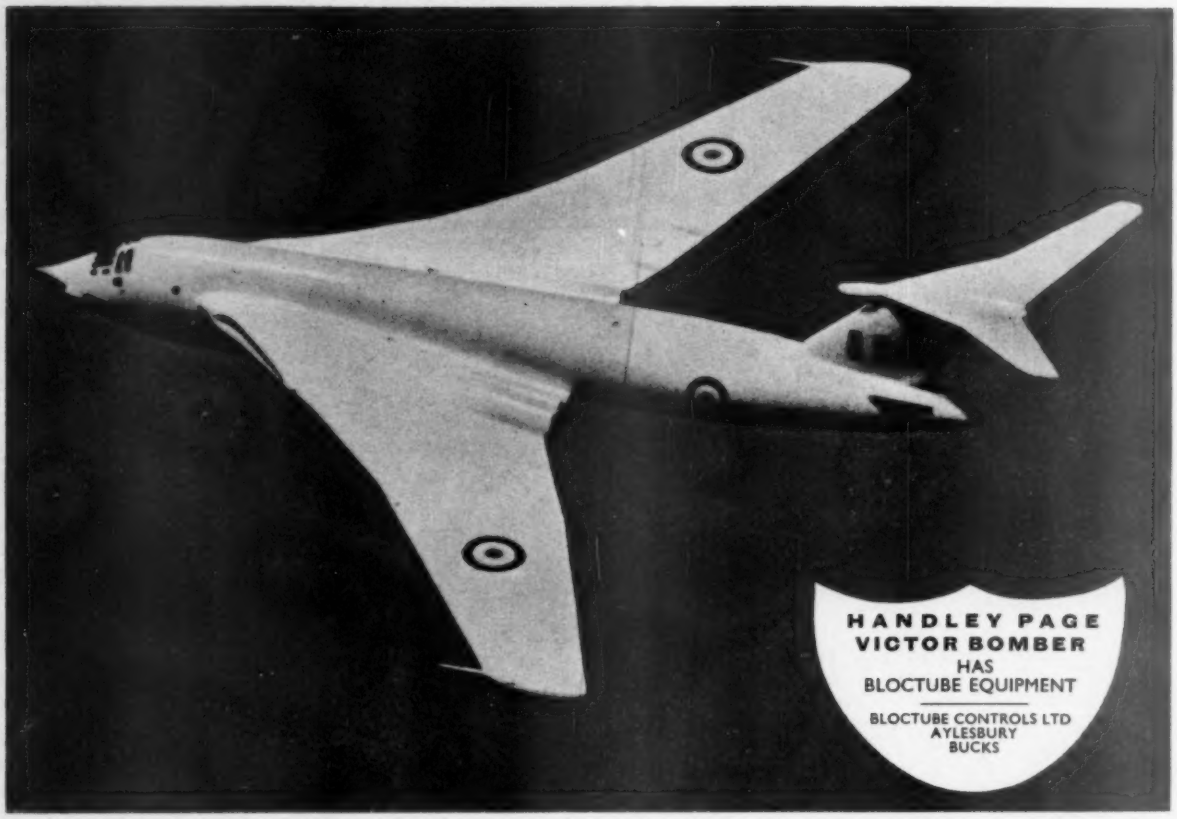

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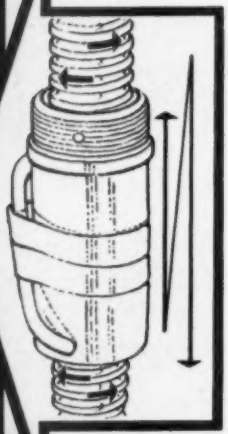

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Head Office:
BOWLING GREEN LANE,
LONDON, E.C.1.
Telephone: Terminus 3636
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Telex: 23839

Vol. 96 No. 2482 MARCH 27, 1959

Annual Subscription Rate: U.K. £4.15.0.
Overseas £5. Canada and U.S.A. $15.00

A P.L.A. FOR L.A.P.?

RECENTLY, a friend on the other side of the Atlantic sent us an article taken from a national business and financial weekly published in the United States in which the leading article was headed, "No grounds for subsidy . . . Federal aid for airports is neither necessary nor wise." Of course, the topic is topical here too and it was with some interest that we followed through the argument. The article was discussing a bill to authorize an outlay of more than half a (U.S.) billion dollars, which would thrust the Federal Government, so the argument continued, further into a sphere which should be the primary concern of municipalities and states. The article deplored the national subsidy of activities that are "essentially commercial and in consequence properly self-supporting."

In this country we have municipal airports and we do have those run by the State through M.T.C.A. and we do have those, of which Lydd or Ferryfield is a shining example, which are effectively self-supporting. But in the view of M.T.C.A., our airports and airfields are costing too much and it was arising out of this situation that proposals were recently put forward by the Aerodrome Owners Association with a view to relieving the Government of part of the financial burden. However, as we reported at the time, M.T.C.A. told the Association that their proposals were not acceptable.

These proposals, however, did not envisage the taking over of London Airport. Yet it is at L.A.P. that efforts to cover, or rather reduce, the discrepancy between revenue and outgoings cause the customers, the aircraft operators, to wish they were dealing with an entity rather than with the multiplicity of departments with which one always gets involved and among whom one is forced to circulate, and frequently to oscillate, when one wants to establish firm relations on some matter. No doubt it is as the result of such experiences that people have been thinking over the idea that L.A.P. should be run by a body similar to the Port of London Authority.

For almost exactly 50 years now the P.L.A. has exercised its jurisdiction over the Thames from Teddington (Tide-ending Town?) Locks to the sea. It runs the docks and services.

The Authority consists of 28 members; 10 of these are appointed by the Admiralty, M.T.C.A., the Corporation of London, by the L.C.C. and by Trinity House; the remainder are elected by payers of rates, wharfingers and owners of rivercraft; the chairman and vice-chairman, who are appointed by the Authority, may (but need not) be elected or appointed members. Executive duties are performed by a staff of 16 headed by a general manager. The working of the Port of London for the year ended March 31, 1957, showed a deficit of £12,048, leaving a surplus balance of £594,782 carried forward.

Today, London Airport, with its area of vast pavemented runways, maintenance hangars, workshops, administrative buildings, its passenger-handling buildings, customs houses and covered passenger ways, is becoming analogous to the congeries of wharves and docks and waterways that form the domain of the P.L.A. But whereas it is a bridge that dominates the busy commercial scene at the Tower, at L.A.P. it is the glass-canopied control tower which stands over all and provides the reminder that the London docks have no need for complex electronic aids to bring the ships safely alongside. And this it is, the enormous complexity and expense of modern control and signalling aids, which make an airport unlike any other transport complex in the World.

Nobody has yet begun to tackle the problem of how to set the costs of aerial communications and control against the transport services which they alone make practical. Indeed, as is well known, the cost of these services is such that experience has shown the need for various bodies, of which I.A.L. is an example, to provide these services in places where the local authorities do not have the resources. At this juncture we do not imagine that anyone would wish to correlate the costs of communication control with air transport services. On the other hand, aircraft operators have always paid dues for landing and take-off, for hangarage and similar services. These are costs which show no sign of diminishing, and in consequence every time some charge is increased there is fresh impetus to the desire on the part of operators to have an independent entity with whom they can negotiate and confer.

At one time there was an idea widely prevalent that to the number of the airline corporations another should be added. This third or fourth corporation should be charged with the task of running the airports of the country. Like many ideas, this one just seemed to die out; no doubt the growing pains of the airline corporations made people wary of bringing another similar body into being. On the other hand, from this necessarily brief examination it does seem possible that the successful working of the P.L.A. might provide a most useful analogy for a London Airport Authority.

C

Matters of Moment

A Chairman's Decade

AT a private dinner party on March 19 B.E.A.'s chairman, Lord Douglas of Kirtleside, was presented by the chief executive, Mr. Anthony Milward, with his B.E.A. 10-year badge. A decade of chairmanship is by way of being a record not only for the two nationalized airlines but, with one exception, for any of the British nationalized industries.

Lord Douglas was appointed to the board of B.O.A.C. in October, 1948, and on March 14, 1949, he was appointed to the chairmanship of B.E.A. His predecessor with B.E.A., Sir Gerard d'Erlanger, is now chairman of B.O.A.C.

Air Affairs at Westminster

QUESTION time in the House of Commons last week brought several matters of aeronautical significance into the limelight—and ranged from space research to fog dispersal. On the former subject, the Minister of Supply was asked about the extent to which his department was co-operating with the United States Government "in furthering space research from the Woomera rocket range in Australia." A clue to the thought behind this was given by a supplementary question in which it was suggested that the Americans were contemplating the launching of a space satellite from Woomera.

Mr. Aubrey Jones explained that satellite tracking at Woomera was done in collaboration with the U.S. and that the results obtained from British upper atmosphere research rockets were made available to America and to other countries under the I.G.Y. arrangements. There was, he said, great American interest in the facilities at Woomera. But the Minister confessed that he did not know exactly what American intentions were in this respect—the questioner was a little premature in his anticipation.

Having had it at least implied that there was some fire behind the satellite smoke, the next question followed almost automatically. Would the Minister tell the House whether his department had yet made up its mind whether we are to launch an Earth satellite programme of our own or whether we are to work in close co-operation with the United States "especially from the Woomera range"?

This brought the non-committal answer that most of the things we do are done in co-operation with the U.S. But the Minister hoped that if there was a British satellite programme it would be co-ordinated with any American programme.

Official encouragement of work on boundary-layer control developments was the subject of another question. There is clearly some concern that this encouragement might not be active enough and that unless there was an intensive research programme in being we might find that our lead in this particular—and very important technique—might be lost.

Although the Minister agreed that we should press ahead with the development, he clearly felt that haste should be made slowly. There is a strong case, he said, for not plunging ahead too wildly without knowing a little more about the subject.

Meantime, while we are finding out a little more about something that has been the subject of research in our wind-tunnels and elsewhere for the best part of 10 years, full-scale flight research into boundary-layer control problems is proceeding apace on the other side of the Atlantic.

Information regarding the control of a phenomenon occurring within the Earth's boundary layer was also sought during question time last week. The Minister was asked about research into the technique of fog dispersal for civil aerodromes.

During last winter, it was pointed out, the airline Corporations

CROP SPRAYER.—Edgar Percival's EP.9, now called the Prospector, and made by the Lancashire Aircraft Corporation, is put through its agricultural paces at Downham Market. The occasion was a demonstration last week of a number of aircraft types used for this work (see page 383).

Photograph copyright "The Aeroplane"

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lost more than £200,000 due to fog—which gives some idea of the economics of the problem (although our information is that this figure applies only to one Corporation). The Parliamentary Secretary to the M.o.S. replied that FIDO was the most promising method of fog dispersal and that the research being done on this system by the Ministry was in collaboration with M.T.C.A. as well as with the R.A.F.

The results of tests to be made in five or six weeks time would be examined to see whether the system would be suitable for civil as well as for military aerodromes. On the question of cost, he said that the system as at present developed would cost between £150 and £250 a landing and that efforts were being made to improve on this figure.

Taking a mean £200 per landing and the £200,000 quoted as the airline loss, it would seem that 1,000 landings in fog could be made before the system became unprofitable. This number of avoided cancellations is a good step in the right direction. But in a winter such as the past one there is certainly room for the improvement mentioned by the Parliamentary Secretary.

News of Britain's Ballistic Missiles

NEW light was cast on the Blue Streak LRBM and the Black Knight test vehicle at a lecture on long-range missiles given on March 19 by MR. E. C. CORNFORD of the R.A.E. before the Astronautics and Guided Flight Section of the R.Ae.S. A film was shown which covered Black Knight development and test firing, and on display was a detailed model of this test vehicle which showed it for the first time in a new form as a two-stage vehicle with a solid-propellent second stage about 7 ft. long.

Black Knight performance was also revealed. This BRTV (ballistic rocket test vehicle), in its single-stage form, reaches an all-burnt velocity of 12,000 ft./sec. at a height of 80 miles. After burn-out it can coast up to a height of 500-600 miles, thereafter falling to re-enter the atmosphere at about 12,000 ft./sec. some 40 miles from its launching point; total flight time is 20 min.

As a single-stage vehicle, Black Knight cannot reproduce the re-entry speed for the nose-cone of a 2,500-n.m. missile which is about 18,000 ft./sec. But in its two-stage form Black Knight can better this with a re-entry speed of 20,000 ft./sec. In this form the vehicle will be used for high-altitude experiments as well as for high-speed re-entry tests.

It can be surmised that a three-stage vehicle made up of Blue Streak plus this two-stage Black Knight would have no difficulty in putting a very small satellite into orbit although, as indicated on page 384, a much larger second stage would be needed if the full satellite-launching potential of Blue Streak is to be used.

It was revealed that only simple guidance is used in Black Knight—"merely to satisfy the Australians," as Mr. Cornford jestingly remarked—and that the missile has a mechanically stabilized structure on aircraft lines and not a pressurization-stabilized structure. It was implied that a heat-sink rather than an ablative re-entry nose-cone was to be tested initially.

The Blue Streak LRBM obviously influenced much of the lecture. Both graphs and text of the lecture referred to a missile of 2,500-n.m. range, which tends to confirm that this is Blue Streak's design range. And MR. J. MULLIN, of the de Havilland Propellers' Blue Streak design team, spoke of the development difficulties involved in making sure that one did not launch "approximately 100 tons of equipment in the wrong direction." This possible reference to Blue Streak's weight

MEXICAN POTENTIALITY.—During her recent stay in Mexico City, H.R.H. the Duchess of Kent visited the British Industrial Centre there. With her here are Mrs. Duncan and Mr. Alex. Duncan of Duncan Y Cossio, S. A. de C. V. The Centre is unique and is considered to be doing a good job in increasing British imports into Mexico.

TWIN TURBINE TRANSPORT.—A hitherto unpublished photograph of the prototype Handley Page Dart Herald. An account, by John Fricker, of flying this Dart-powered transport is on pages 380-2.

Photograph copyright "The Aeroplane"

lines up to some degree with the weight estimate for this missile given on page 384.

Another reference by Mr. Mullin indicates the development time for Blue Streak up to its first firing. According to him, Mr. Cornford's lecture had crammed this period for Black Knight into an hour, while he reckoned this was about 10,000 times too short. This suggests a development time of four to five years for Blue Streak to the stage when firing trials begin.

Keeping up the Export Pressure

FINANCIAL AID—in the form of some sort of contribution from the Ministry of Supply towards the development cost—for projects which have a useful export potential, is something that is frequently argued as essential if our aircraft industry is to compete in the world markets. But although this help is sometimes forthcoming it rarely seems to materialize to the extent that the recipients consider to be adequate.

There is, of course, much to be said on both sides of this somewhat contentious problem—with the Treasury on the one hand keeping a tight hold on the national purse strings and industry on the other doing its best to get more business overseas. Unfortunately, in aeronautical engineering in particular, a lot of money has to be spent before there is any sign of a positive return for it and few concerns are in a position to shoulder the major part of this initial burden without assistance. Just how much help is justified is difficult to ascertain and in any case it is likely to vary according to circumstances. One thing is clear, however, the industry needs all the aid it can get if the export graph is to maintain its upward trend or even keep level in the face of reductions in military spending.

This rather difficult problem was raised recently by Sir George Nelson, Bt., in his annual chairman's address to the shareholders of the English Electric Group of companies. He was speaking of Napier's development of the Eland turboprop powerplant to a stage where it was fully proven by official tests as satisfactory for airline operation.

It must be realized, commented Sir George, that the development and perfection of such aero-engines demands immense expenditure which can only be recovered from business extending a long way in the future, and that unrecovered development expenditure had to be carried forward in the accounts. "We think that the Government should give careful consideration to the revision of the present policy of providing only a limited contribution towards the cost of development of equipment which has proved suitable for overseas markets and we are pressing the Government for support in this field."

Powerplant Statistics

HAVING had something to say last week about the need for a short-haul high-capacity "bread-and-butter" transport aeroplane without frills and possibly powered by piston engines, it was interesting to find in our post-bag the next day some remarkable statistics concerning the Bristol Hercules radial. In the present-day atmosphere of turbojets and turboprops one tends to overlook the fact that this widely used sleeve-valve powerplant is still in production.

Although more than 60,000 Hercules engines have been made, it is still being manufactured by Bristol Siddeley Engines for the French Nord Noratlas and for the Spanish Azor. In addition to these home-built powerplants it is in production under licence in France by SNECMA, who have now completed more than 700 for the Noratlas transports used by the French and West German Air Forces.

All these Noratlas engines are said to enjoy an exceptional record of reliability; they are now being operated for 1,200 hours between overhauls and they have an "achieved" life of no less than 94%. In point of fact Bristol Siddeley believe that the rate of "involuntary" engine removal—one per 7,376 flying hours—is the lowest ever achieved.

Altogether more than 500 civil aircraft are flying at the present time with Hercules engines, which are being operated for more than 1,000,000 engine hours a year. And over and above these civil Hercules large numbers are still in military service.

One way or another, this is quite an achievement for an engine which made its debut as long ago as 1936.

A Coventry Designer Retires

MR. JOHN LLOYD, F.R.Ae.S., who was chief designer of Sir W. G. Armstrong Whitworth Aircraft, Ltd., from 1923 to 1948, when he was appointed technical director, is to retire. In 1955 he relinquished the post of technical director, but remained on the board.

Born at Swansea on October 20, 1888, John Lloyd was at the Royal Aircraft Establishment, Farnborough, from 1914 to 1917 as head of the stress section. He left there to join the Siddeley Deasy Co. at Coventry, where he stayed until 1923. In his capacity as A.W. chief designer he was responsible for a wide range of aircraft, including the Siskin single-seat fighter, the Atlas army co-operation biplane, and the three-engined commercial biplane known as the Argosy which flew for so many years on Imperial Airways' Silver Wing cross-Channel service. These were followed by the Atalanta and Ensign four-engined monoplanes which also gave extensive service with Imperial Airways.

Mr. Lloyd was also later concerned with the Whitley bomber, the experimental A.W.52 flying wing and the Apollo four-turbine prototype. His experience has thus extended from early wire-braced biplanes to the type of aircraft familiar today.

Source of True Knowledge

WITHIN easy reach of my desk there is a battery of books of which I am in constant need for reference. Foremost among them are "THE AEROPLANE Directories" dating back to 1936. (It was "Who's Who in British Aviation" until 1949.) The old volumes are useful for details of posts people held in olden days, and the list of deaths during the year often provides wanted information from the past.

Now the 1959 edition has been published and I feel that all's right with the world again and my source of information is bang up to date. The new edition costs 30s., a high price perhaps compared with 7s. 6d. for the 1947 edition. But apart from the fact that costs of everything have trebled since then, the aeronautical community has grown enormously in size as well as complication and there is more than twice as much information now as there was then.

Only twice in the myriad of times I have consulted it has the Directory failed me. Once was when I searched the index for a clue to the whereabouts of civil airport managers. Eventually I discovered this came under "Aerodrome Commandants and Managers." There might well be an entry in the index, "Airports, see aerodromes," for if I can go wrong over that so can others.

There are the salient facts on personnel for the R.A.F. and the air branches of the Navy, Army and Ministry of Defence, and the Commonwealth air services, and of the various civil ministries that impinge on air.

The section dealing with the British aviation industry is particularly valuable and includes such novelties as "The Aircraft Manufacturing Co., Ltd.," and "Bristol Siddeley Engines," so one knows a bit better where one is.

There is a useful section giving details of commercial aviation enterprises in the U.K. and Commonwealth, another for International organizations such as the FAI, ICAO and IATA. I wish they weren't listed as "bodies" as that sounds so dead whereas they're very much alive! And we have a section dealing with more of the quick and the dead headed "Learned bodies, Societies and Clubs," and then comes the Aeronautical Press, and Aeronautical Training which lists technical training courses, colleges and private firms who run apprentices schemes of one sort or another.

The "Who's Who" section is as comprehensive as ever and includes anyone of note who has been on the job for at least a year. And if you were in aviation before 1919 you are in for life—there is no escape!

In reviewing a book it's the done thing to try to pick holes in it, but apart from one or two teeny tiny holes, which don't detract from the superlative value of the book, I can find precious little to moan about. It is a "must" for the desk of every intelligent person in the aeronautical community in search of accurate information. Nothing contrived by human hand and brain can be perfect, but the 1959 edition of "THE AEROPLANE Directory" is as near perfection as dammit.—G.D.

General Aviation News

SIKORSKY DEBUT.—The U.S. Navy's first all-weather helicopter, the Sikorsky HSS-2, powered by two 1,050-s.h.p. General Electric T58-6 gas turbines, was to have been publicly displayed for the first time on March 24. This amphibious aircraft is primarily for anti-submarine work. A $32-million contract for the type has been awarded.

HELP FOR TIGERS.—The Tiger Club is pleased to announce that, through the good offices of the Air League, it has received a gift of £150 from the S.B.A.C. to be used for encouraging young British pilots to practise aerobatics to compete in the British Lockheed aerobatic contest.

RUSSIAN MISSILES. — Dr. Fred Singer, a leading U.S.A.F. consultant, has said that two fatal mistakes have been made in the Russian ballistic-missile programme. These were to build ICBMs which were much too large and to neglect solid propellants in favour of liquid ones. He has estimated that each Russian ICBM needs about 500,000 lb. of propellants.

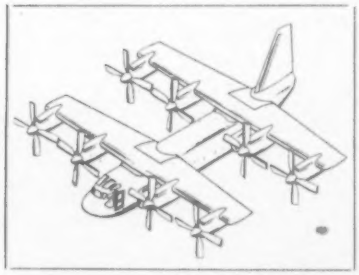
ROTODYNE RECORD. — The R.Ae.C. has announced that the 100-km. closed-circuit speed record for convertiplanes set up by the Fairey Rotodyne (two Napier Eland shaft turbines) on January 5 has now been officially confirmed by the F.A.I. The speed achieved was 190.9 m.p.h. (307.22 km.p.h.).

COLEOPTER PROGRESS. — The SNECMA C.450 Coleopter is now at Melun-Villaroche undergoing preliminary tethered-flight tests in a gantry.

BOULTON PAUL VTOL.—It is now officially stated that, as mentioned some time ago in THE AEROPLANE, Boulton Paul Aircraft, Ltd., of Wolverhampton, has been assisting the Ministry of Supply in investigating the possibilities of applying new forms of direct lift to VTOL aircraft. Since the War the company has been mainly engaged on development work relative to control systems and instrumentation involving electronics.

R-R/WESTINGHOUSE. — Rolls-Royce, Ltd., and the Westinghouse Electric Corp. have discussed plans for the joint development of a military turboprop engine.

VIPER ENDURANCE. — A standard Bristol Siddeley Viper 8 recently completed a 500-hr. endurance flying programme in a Hunting Jet Provost. During this programme an average of 5¾ hr. flying a day was achieved; 22% of the 500 hr. were flown at take-off r.p.m.



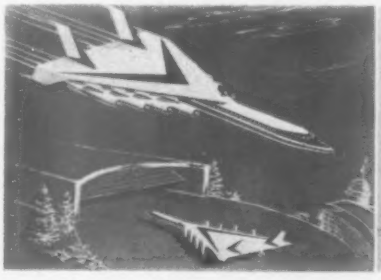
AMERICAN IDEAS.—Above, an eight-engined tilt-wing VTOL configuration, weighing 60,000 lb., proposed by Hiller Aircraft. On the right are two impressions which illustrate i a paper given in the U.S.A. by J. A. O'Malley, Jnr., of the Bell Aircraft Corpn. They show a supersonic 100-passenger aircraft with eight rotatable powerplant packages, and a 120-passenger canard design using afterburner engine thrust.

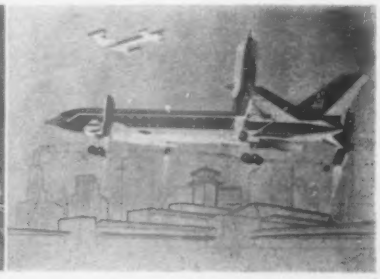
IRBM POWERPLANT.—Final adjustments being made at the Rocketdyne Division of North American Aviation, Inc., to an engine for the Jupiter IRBM developed by the U.S. Army and to be deployed operationally by the Strategic Air Command.

TRAINING MISSION.—A Fairey Aviation training mission is to be based at Surabaya, Indonesia, for 18-24 months, from about next July, in connection with the supply to Indonesia of 18 Gannets. The mission will include a qualified flying instructor and specialists in airframes, engines, electrics, radio/radar and ordnance; suitable personnel are now being recruited by the company. The first six aircraft are expected to be delivered at the end of this year, after being reconditioned at White Waltham. The first batch of Indonesian pilots will be trained in Britain.

HELICOPTER MARKETS.—Stanley Hiller, Jnr., said recently in New York that there was a growing World market for civilian light helicopters. His company's three-seat 12E helicopter was, he said, expected to capture sufficient sales to balance commercial and military business.

ALOUETTES ABROAD.—Three Sud-Aviation Alouette II helicopters have been ordered for general duties by a private company in Israel, where one Alouette is already flying. The first two Alouettes of six ordered by Holland were handed over on March 11.





U.S. LIGHTWEIGHTS.—Top, the Paraplane Commuter two-seater is the latest version of the STOL aircraft produced by the Lanier Aircraft Corpn., of Marlton, N.J. It is powered by a 150-h.p. Lycoming O-320 engine and has a speed range of 15-165 m.p.h.

The lower picture shows the all-metal prototype Meyers 200. It cruises at 195 m.p.h. and has a range of 1,100 miles. The loaded weight is 3,000 lb.

Howard Levy photograph

SNECMA TEST-BEDS.—Last year the SNECMA company extended its engine test facilities at Melun-Villaroche. New equipment includes beds capable of taking turbojet engines of up to 22,000-lb. thrust.

WIRRAWAY HISTORY. — An historic R.A.A.F. trainer — Wirraway A20-103—is to be placed on permanent display alongside other aircraft in the Aeroplane Hall at the Australian War Memorial in Canberra. It was in this Wirraway that Plt. Off. J. S. Archer, R.A.A.F., shot down a Japanese Zero off the New Guinea coast on Boxing Day, 1942.

TRANSISTOR PROGRESS.—Texas Instruments, of Dallas, who produce semi-conductor devices, such as transistors, report a most successful year; sales were 37% higher and earnings, after tax deductions, 60% more than in 1957. The report says, too, that the British subsidiary at Bedford became a profitable operation during its first full year of activity.

Commercial Aviation Affairs

DECCA DECISION.—Answering questions in the House last week, Mr. Harold Watkinson agreed that it would be wise for the final decision on a short-range navigational aid to be delayed for a period for further technical advice to be accumulated. He would consider the suggestion that Commonwealth operators should get together and make a combined recommendation.

LOW-COST HEARINGS.—The applications by Eagle, Hunting-Clan and Airwork for permission to operate low-cost services between Britain and points in the Commonwealth will be considered jointly by the A.T.A.C. The hearings will begin in London on April 3.

IRISH BOEINGS.—The three Boeing 720s ordered by Irish Air Lines (see THE AEROPLANE for March 20) will have a gross weight of 217,000 lb., compared with the 212,000 lb. announced for the domestic versions ordered by American Airlines and United Airlines. The fuel capacity remains unchanged, and Boeing have now confirmed that Pratt & Whitney JT-3C-7 engines will be used.

EXCHANGE NEWS.—The Aircraft Exchange in New York continues to report progress and the 10th *Market Report* reflects bids and offers totalling more than $80 million. A briefing was held recently on the activities of the Exchange and its membership—which includes all U.S. manufacturers of airline aircraft and the "big four" U.S. trunklines—for the benefit of industry, financial and Government interests. A study is being made of means whereby new turbojet aircraft can be offered on lease through the Exchange.

UNITED RESULT.—Records in traffic and operating revenues and in earnings are reported by United Air Lines for 1958. Net earnings provided the equivalent of $4.05 for each share outstanding ($2.38 in 1957). Factors influencing these results were strikes against other operators; the 6% fare increase of February, 1958; elimination or reduction of various discounts; and a change in depreciation policy which reduced operating expense by $3,190,000. The United fleet increased to 197 aircraft in 1958, and the first DC-8 is expected in late spring, 1959. Advance payments on jet aircraft in 1958 totalled $45,502,000.

DEMONSTRATIVE DELIVERY.—The second Comet 4 for Aerolineas Argentinas left for Buenos Aires on March 18. It was making demonstrations at Paris, Frankfurt, Amsterdam, Rome, Madrid and Lisbon before going on to Argentina via Dakar and Recife.

COMET NAMES.—The first three Argentine Comet 4s have been named Lucero de la Tarde (Evening Star), Lucero del Alba (Morning Star), and Tres Marias (the three stars forming Orion's belt). One of the second batch of three Comets will be named Crus del Sur (Southern Cross). Service from Buenos Aires to Santiago will begin on April 19, to London on May 19 and to New York on May 25.

NEW SERVICES APPROVED.—Among scheduled services newly approved by the M.T.C.A. on the A.T.A.C.'s recommendation is a coach-class service between Dar-es-Salaam, Nairobi, Entebbe and London by East African Airways Corporation. An internal service between Croydon and Brawdy by Morton Air Services has also been approved.

N.Z. VISCOUNTS.—The second of three Viscount 807s ordered by N.Z.N.A.C. has arrived at Christchurch Airport. Meanwhile the first has completed 12 months' operation and has carried 47,915 passengers—40% more than the DC-3 which it replaced.

B.O.A.C. FLUORESCENCE.—B.O.A.C. is sponsoring a series of tests with various types of fluorescent paint to ascertain whether there is any corrosive damage to aircraft; later trials will show their resilience in service and the best patterns of markings to enhance the aircraft's visibility.

T.W.A. JET SERVICE. — Boeing 707-131s, which went into service with T.W.A. on the New York-San Francisco route on March 20, are arranged to carry 46 first-class and 65 tourist passengers. T.W.A. will introduce jet services to Los Angeles, Chicago, St. Louis, Washington D.C., and Philadelphia in the near future.

FRIENDSHIP HOURS.—By the first week in February, Fokker and Fairchild F-27s in regular airline operation had flown about 10,200 hr. This total is in addition to 1,855 hr. flown by test aircraft. The F-27 is now in service with Bonanza Airlines.

FRIENDSHIP STRETCHED.—Pacific Air Lines, of San Francisco, is the first operator to take delivery of the F-27A version of the Fairchild Friendship. This has Rolls-Royce Dart 528 (R.Da.7) turboprops instead of the 511 (R.Da.6) type, and is arranged as a 44-seater. Pacific will start F-27 services on May 1.

INCLUSIVE TOURS TO CAIRO.—In the winter of 1959-60, Airwork, in conjunction with Milbanke Tours, plans to operate inclusive tours to Cairo, using Viscount 800s.

FASTER RESERVATIONS.—T.C.A. has placed a $2 million order with Ferranti-Packard Electric, Ltd., for electronic seat reservation equipment. The system comprises a central computer, and devices known as Transactors in all T.C.A. booking offices. In operation a pencil-marked card is inserted in the Transactor, which then ascertains from the central computer whether space is available on the required flight and provides the answer by punching a hole in the card.

FREIGHT APPLICATION. — Seaboard and Western Airlines has applied to the C.A.B. for permission to operate freight and mail services across the Pacific, from the east-coast, mid-west and west-coast areas of the U.S.A. to points in the Far East and Southwest Pacific. Rights at various intermediate points are also requested.

ARGONAUT CHARTERS.—Overseas Aviation (C.I.), Ltd., now has two ex-B.O.A.C. Argonauts in its fleet. One of these recently completed a charter flight to Rio de Janeiro.

CHARGES DEFERRED.—The 50% increase in the passenger service charge will be deferred for a month or so after April 1 to allow airlines to complete arrangements with travel agents for its pre-collection. The increased landing fees at British airports will be charged from April 1.

News About People

NAPIER CHANGES.—Last week we mentioned briefly the amalgamation of the various branches of D. Napier and Son, Ltd., to form one technical division under Mr. A. J. Penn. Appointments which have resulted include Mr. R. H. Chamberlin as chief engineer; Mr. R. A. Gilbert as chief designer; Mr. D. P. Ferguson, assistant chief engineer (aero); Mr. J. S. Clough, engine test manager; Mr. D. C. Broadbent, assistant chief designer (aero), and Mr. F. R. Heath, chief development engineer (aero). Dr. A. W. Morley continues as forward projects engineer.

Top, Mr. R. H. Chamberlin and Mr. R. A. Gilbert, and bottom, Mr. D. P. Ferguson and Dr. A. W. Morley.

ALUMINIUM EXECUTIVES.—The following forthcoming appointments at the Rolling Mills of the British Aluminium Co., Ltd., are announced: Mr. J. A. Richmond, as deputy manager, Falkirk, to succeed Mr. Field as manager, Falkirk, when the latter retires on January 23, 1960; Mr. T. D. Rees, deputy manager, Latchford; Mr. R. L. C. McDonald, assistant manager, Warrington; Mr. F. C. Foskett, chief production superintendent, Milton; Mr. N. MacDonald, deputy chief production superintendent, Milton; and Mr. D. Lowe, superintendent, experimental department, Milton. Following the retirement of Mr. H. W. L. Phillips in September next, the following changes will be made at the research laboratories, Chalfont Park: Mr. A. C. Coates, assistant director of research (chemical), and deputy to Dr. Pearson; Mr. P. C. Varley, assistant director of research (metallurgical); Dr. C. E. Ransley, senior research metallurgist, and Dr. F. A. Champion, senior research chemist.

AIRLINE APPOINTMENT. — Mr. G. C. Draper will join Central African Airways as traffic and sales manager on June 1. In his new post Mr. Draper will be head of C.A.A.'s commercial division and will be responsible for the traffic, sales and publicity departments. An expert in marketing, Mr. Draper has been publicity manager of Aer Lingus since 1956.

HUNTING P.R. APPOINTMENTS.—As recorded last week, Gp. Capt. Lucas is appointed public relations officer to Hunting Aircraft, Ltd., and its subsidiaries at Luton. Mr. David Bolton has been appointed public relations officer to Hunting-Clan Air Transport, Ltd. Mr. David Bett continues at the Group Headquarters in London. Mr. Hugh Scanlan has left to take up an appointment with Shell.

HELP WANTED.—The British Gliding Association is in urgent need of more assistance for the National Gliding Championships to be held at Lasham from May 9 to 18. In particular tug handlers, tow-rope collectors, tug pilots (who must have had previous towing experience and flown at least 80 hr. solo), and turning-point observers are required. Any who are prepared to help in this respect should contact the B.G.A. at Londonderry House, 19 Park Lane, London, W.1. (Telephone, Hyde Park 3341.)

DOUGLAS LECTURE.—On April 8 Donald Douglas, Jnr., president of the Douglas Aircraft Co., will lecture on "The American Aircraft Industry" to the graduates' and students' section of the Royal Aeronautical Society at 4 Hamilton Place, London, W.1, at 19.30 hrs.

AIR BRIDGE MANAGER.—Mr. G. P. Parcelle has recently been appointed traffic manager of the Channel Air Bridge Division of Air Charter. Prior to joining the Army in 1941, he was on the staff of the traffic manager of Southern Railway Co., with the special responsibilities for Railway Air Services.

SPACE LECTURE. — Professor F. Hoyle, F.R.S., is to deliver the 1959 May Lecture of the Institute of Metals; his subject will be "The Scientific Uses of Space Exploration." The meeting will be held in the lecture theatre of the Royal Institution, Albemarle Street, London, W.1, at 19.00 hrs. on April 14. Visitors will be welcome and no tickets are required.

I.D.C. AT D.H.—Maj.-Gen. D. S. S. O'Connor, C.B., C.B.E. (centre, dark coat) Senior Army Directing Staff, Imperial Defence College, and senior officers and civilians from the Commonwealth and the U.S.A. visited the de Havilland Enterprise at Hatfield and Leavesden on March 17. The Firestreak AAM, the Blue Streak LRBM, the Gyron Junior turbojet and the Gnome shaft-turbine engine were seen and discussed. Mr. R. E. Bishop and Dr. E. S. Moult addressed the visitors.

Air Transport

Inquiries and Investigations

DURING the past few years there has been something of a surfeit of public inquiries into air transport accidents. The frequency of these inquiries has been such that most people, even those in the aviation business, may have come unconsciously to the conclusion that all accidents involving the lives of fare-paying passengers must automatically be the subject of these involved and sometimes rather dreary exhibitions of forensic virtuosity.

In fact, there is no statutory reason for the holding of a public inquiry in the case of any accident, however serious. The decision as to whether or not such an inquiry should be held is made by the Minister of Transport and Civil Aviation when such a course appears to be expedient in order to calm public doubts or to satisfy public interest. Such a decision was reached in the case of the Southall accident.

The basic facts leading to this accident had already been brought out at an inquest, and these facts were outlined in THE AEROPLANE of February 6, pp. 142-143; more information may emerge from the inquiry and this will be given when the full report is eventually published. But not even the report of a public inquiry is *necessarily* made public—though the Minister must have good reasons for withholding it.

Until comparatively recently an accident was much more usually followed by a private inquiry by M.T.C.A.'s Accident Investigation (Civil Aviation) Department, which, in due course, provides a report for the Minister. This report is not necessarily made public; its issue depends on the decision of the Minister and has sometimes been withheld.

The Cost of the Service

IN the last full financial year, ending on March 31, 1958, civil aviation services in Britain cost a total of £12,163,400. This covered the cost of construction, maintenance and operation of aerodromes and other services in connection with civil aviation. The largest single item in this total was £4,905,000 for capital expenditure, and a further £1,248,000 for current expenditure, in respect of works, buildings and lands. Capital and current expenditure on equipment and ancillary services amounted to £2,000,000.

Among the other items included in the total is worth noting that Britain's subscription to ICAO for the year was £113,778 2s. and that the M.T.C.A. contribution to B.E.A.'s experimental helicopter operations was £30,879. The cost of the Air Transport Advisory Council was £17,800, in addition to the salaries of civil servants involved in the Council's work.

The Civil Appropriation Accounts for 1957-58, giving these figures, show that grants made by the M.T.C.A. towards new works, additions and alterations at airports included £100,000 for the extension of terminal building, apron and runway at Elmdon; £72,500 for improvements at Blackbushe; £30,000 for the terminal building at Renfrew, and £400,000 towards the development of Ringway. Expenditure on Gatwick Airport in the year totalled £3,106,356, and strengthening and extending the main runway at Prestwick cost £170,534.

The Camberley Accident

THE incorrect reassembly of an elevator spring-tab, effectively reversing its operation, was the cause of the accident during a test flight on December 2, 1958, to the Hunting-Clan Air Transport Viscount 732, G-ANRR. This was revealed at the inquest last week on the six members of the test crew, including the company's chief pilot, Capt. R. W. L. Mulliner.

The aircraft was airborne for 14 minutes or less and during this time radio messages showed that it was partially or wholly out of control, with " violent lurches upwards and downwards " and an inability to fly straight and level. It finally broke up in the air.

According to the evidence at the inquest certain new parts intended for the trim-tab on the starboard elevator had been fitted instead to the spring-tab on the port elevator.

Opportunity for the Argosy

SELECTION of the Armstrong Whitworth Argosy for operation by Riddle Airlines, announced last month (THE AEROPLANE, February 27), may prove to be key factors in the future development of both the aircraft and the airline. Apart from the R.A.F. order for the military A.W.660, this is the first firm contract placed with Armstrong Whitworth for their private-venture, Dart-engined freighter; and it is a striking tribute to the aircraft that a foreign airline should thus be prepared to become the first civil customer.

The size of the Riddle order has not been specified but is, we understand, for an initial quantity of four, which will be among the batch of 10 already laid down by the company. Delivery of these should be completed during 1960, subject to successful conclusion of American certification and the incorporation of any necessary modifications. One of the more serious problems is the F.A.A. requirement for a flight engineer's station in all aircraft grossing more than 80,000 lb.

British certification is expected by mid-1960, using the first three Argosies. The prototype has logged about 35 hours since its first flight on January 8, and the second of the pre-production batch made its first flight two weeks ago. Prior to delivery of the Riddle aircraft, it is planned to make one of the trials aircraft available for route proving and, subject to F.A.A. agreement to the use of a non-certificated aircraft

(*Continued on page 369*)

RIDDLE SOLUTION.—Choice of the Armstrong Whitworth Argosy by Riddle Airlines of Miami could prove to be a significant break-through for this new British freighter. The first Argosy is illustrated here; the second made its first flight at Bitteswell on March 14.

The facts and figures give me confidence in the VISCOUNT

Continental Airlines' results exceeded expectations

These are the figures after six months' operation

Average fleet for period: 5.6 aircraft

Total revenue	$ 2,599,962
Direct expenses	$ 1,126,817
Indirect expenses	$ 954,188
Net operating income	$ 518,957
Income per mile	31.16 cents
Average load factor	47.17%
Break-even load factor	37.3% (twenty passengers)
Percentage indirect/ direct costs	84.68
Revenue passenger miles	40,845,739
Yield per revenue passenger-mile	6.08 cents

In May last year, Continental became the first airline to operate the Viscount 810 on the American continent. According to President Robert F. Six, performance, passenger appeal and economics of the new aircraft exceeded the expectations of the company. In the first three months 1,200,000 plane miles were logged, and seat mile costs were .30 cents below estimate. Although bigger and faster than earlier Viscounts, air mile costs of the 810 are no higher.

Latest improvements in performance enable Viscount 810 to offer even greater performance for operators

- ★ Take-off weight now 72,500 lb (up 3,500 lb)
- ★ Landing weight, zero fuel weight and payload all increased by 2,000 lb
- ★ Maximum payload range increased to 1200 miles
- ★ Cruising speed 365 m.p.h. When re-engined with more powerful Darts, 400 m.p.h.
- ★ Backed by Vickers/Rolls-Royce jet-prop experience of over 350 Viscounts in service with 39 airlines
- ★ Viscount 810/840 already ordered by Continental Airlines, Lufthansa, South African Airways, Ansett-A.N.A., Airwork, Cubana, Hunting-Clan, Pakistan International Airlines, T.A.A. and V.A.S.P.

VICKERS VISCOUNT 810/840

FOUR ROLLS-ROYCE DART JET-PROP ENGINES

• *Fastest and most economical medium-sized airliner in the world*

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY ENGLAND

TGA AT611/A

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FOR SALE

DE HAVILLAND **AMBASSADOR** AIRLINERS

A unique opportunity now exists for you to acquire from British European Airways up to fourteen modern de Havilland AMBASSADOR airliners with low airframe hours. Suitable for "HIGH DENSITY" passenger traffic or alternative passenger-cum-freight, with large freight door fitted if required. If you are an Industrialist this is your aircraft after simple and economic conversion to executive standard or "FLYING SHOW ROOM."

- Currently fitted luxury 49-seats at 39" pitch, capable of simple modification to high density seating configuration.
- Fully pressurised passenger cabin and freight holds.
- Two Bristol Centaurus 661 engines with world-wide proven reliability are fitted. Highest approved engine overhaul life for any piston engine. Bristol's offer "one-for-one" exchange scheme.
- Modern radio and navigational aids fitted.
- High wing and large windows offer maximum passenger appeal. Underslung fuselage simplifies freight loading.
- To reduce first-year operating costs, aircraft can be delivered with twelve months' British Certificate of Airworthiness—major Check IV completed. Low engine hours, propeller hours, since last overhaul—all mandatory and essential modifications incorporated.
- Low initial capital cost—extended payment terms available.
- Economic cruising speed 240 m.p.h. (386 kms.)
- Free demonstration flights at your airfield will be arranged.
- Crew and Engineers training available.

BEA

For full details, cable 'phone or call:—JAMES CUMING

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IN SERVICE.—T.W.A. put their Boeing 707-120s into service on March 20 between New York and San Francisco. As this picture shows, the traditional T.W.A. red-and-white trim lines have been replaced by a more dramatic stylized red arrow running the length of the fuselage.

(*Continued from page 368*)

in this way, such trials are likely to be made late this year or early in 1960.

Riddle is the fifth largest of the U.S. all-freight carriers, and, in common with the others, has been having a tough time. A considerable improvement has been made since Mr. George L. Giles became president on February 15, 1958, as a result of the close attention he has paid to getting down overheads, streamlining organization and eliminating all activities not directly concerned with cargo flying. As a result, the loss made on every ton-mile flown has been reduced to three cents from over five cents. In the opinion of the company the remaining gap can only be closed, and a profit made, by the acquisition of new equipment to replace the fleet of 32 Curtiss C-46s, with their direct operating costs of 15.6 cents/ton-mile.

The Argosy has been chosen as the best available new aeroplane for the present scheduled route network, which is based on Miami and extends to 26 cities in the U.S. to the north and north-east and to San Juan in Puerto Rico. Among the points listed in favour of the Argosy were its fore-and-aft loading at truck-bed level; its reversible tie-down floor panels; its payload and speed, both approximately double those of the C-46; its D.O.C. of 9-10 cents/ton-mile; and the favourable financing terms offered by A.W.A.—reported to be 10% down and the remainder spread over six years starting a year after delivery. Price, delivered in Miami, is about $1.5 million each, including the 12½% import duty.

There is no doubt that the proving of the Argosy over the Riddle network will be closely watched by the whole air-freighting community.

K.L.M. and Singapore

IN last week's issue (p. 356) the final U.K. decision about terminal traffic rights for K.L.M. at Singapore was briefly recorded; the British Government has decided that a once-weekly frequency will be just and adequate in normal commercial conditions and this frequency will apply as from April 1.

Briefly, the circumstances so far have been these: The 1946 U.K.-Netherlands air agreement did not allow for terminal rights at Singapore though K.L.M. operated through this point on its way to and from Djakarta. Following the crisis in 1957 K.L.M.'s Djakarta traffic rights were withdrawn by the Indonesian Government and permission was consequently given by the U.K. for five services to be terminated at Singapore so that Dutch nationals could be flown home.

As this refugee traffic decreased the permitted Singapore-Amsterdam frequency was reduced to three services per week in March, 1958, and to two per week in June, 1958. Early this year the permitted frequency was reduced to once weekly, but the enforcement of the reduction was delayed pending further talks.

The main additional reasons given for the British decision are:—

A route to and from Singapore is both more valuable to K.L.M. and more commercially threatening to B.O.A.C. than a transit route through to Indonesia, since the whole capacity of the aircraft is available for traffic to or from Singapore; K.L.M. can thus compete directly with B.O.A.C. for Singapore-Europe traffic.

Consequently the grant of a terminating route is in itself a concession to the Netherlands. The U.K. feels no obligation to allow the route to be used for excessive competition with its airlines; its use must be limited to the reasonable needs of Singapore-Netherlands traffic.

The agreed figures show that Singapore-Netherlands traffic on K.L.M.'s service is now averaging 26 or 27 passengers per week in each direction. These passengers can be comfortably accommodated on one weekly service and the whole of any additional capacity is in direct competition with B.O.A.C. and Qantas.

The U.K. does not agree that a single weekly service between the Netherlands and Singapore is commercially impossible for K.L.M. It is clear from the traffic figures that the determining commercial factor for K.L.M. is the traffic to and from intermediate points rather than at Singapore; and a frequent service to these would be provided by K.L.M.'s network of Far Eastern routes irrespective of the number of services K.L.M. operates to Singapore.

In spite of the fact that K.L.M. and B.O.A.C. are strong competitors, the U.K. has given K.L.M. generous treatment over British traffic rights. They have very valuable rights through Prestwick for transatlantic traffic which are not balanced by any compensating rights for British airlines in Dutch territory.

K.L.M.'s existing rights *through* Singapore to Indonesia remain in the air services agreement to be taken up (instead of the temporary terminating rights) as soon as conditions permit and the airline wishes to do so.

South Africa's 707s

THE Boeing 707-320s ordered by South African Airways will be able to make a two-stage flight to Britain from South Africa with a full load. This was stated by the general manager of the South African Railways Administration when commenting on local reports that the £6 million deal for the three turbojets might need to be cancelled because it was thought that they would not be able to take-off at an adequate weight from Johannesburg's Jan Smuts Airport—which is at an elevation of 5,559 ft., has a maximum runway length of 10,500 ft. and a mean hottest-month temperature of about 22° C.

He is reported to have said that the 707 will be able "to make a one-stop flight to Europe with a full load of passengers." This one-stop service, if instituted, would be by way of Leopoldville. Normal east coast flights will be flown with fewer stops than at present—Khartoum being overflown on the Nairobi-Rome part of the route.

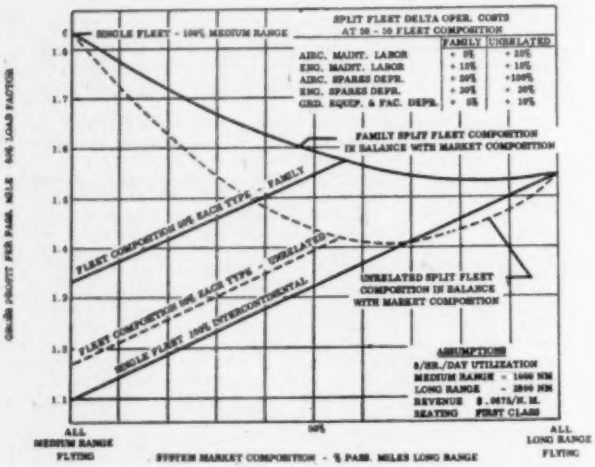
The proposed stages may, therefore, be: Johannesburg-Leopoldville, 1,505 n. miles; Leopoldville-L.A.P., 3,445 n. miles; Johannesburg-Nairobi, 1,570 n. miles; Nairobi-Rome, 2,920 n. miles; Rome-L.A.P., 790 n. miles. These distances are reasonable enough for the 707-320 on a runway/payload/range basis even at the aerodrome elevations and temperatures involved. Leopoldville now has its new runway, with a length of 15,420 ft., in operational use. The only doubtful stage might be that from Nairobi to Rome, which would involve a fairly high-weight take-off from Nairobi's Embakasi Airport, with its runway length of 10,000 ft. and elevation of 5,327 ft.

The Transport Family Concept

Some advantages of offering a family of related turbojet transport designs—such as the extensive Boeing 707/720 series—are discussed here by two Boeing engineers.

WHEN the Boeing Airplane Company set out to produce a civil jet transport, its objective was to satisfy, with a single aeroplane, a large segment of what appeared to be a very large market. Under the pressure of intense competition, however, and to meet specific airline needs, the Boeing 707 has become a whole family of designs. Two senior Boeing engineers, in independent papers,* have recently examined the inter-relationship of the various members of the family, and have sought to show the effect upon airline profitability of the use of such a family of related designs in favour of using a single aircraft type or unrelated types.

The two papers—which appear to be directed primarily at purchasers of the Boeing 707 who might be in the market for other members of the family—are summarized here.


SPLIT FLEET DELTA OPER. COSTS AT 50 - 50 FLEET COMPOSITION
SINGLE FLEET - 100% MEDIUM RANGE
FAMILY
UNRELATED
AIRC. MAINT. LABOR
ENG. MAINT. LABOR
AIRC. SPARES DEPR.
ENG. SPARES DEPR.
GRD. EQUIP. & FAC. DEPR.
FAMILY SPLIT FLEET COMPOSITION IN BALANCE WITH MARKET COMPOSITION
FLEET COMPOSITION 50% EACH TYPE - FAMILY
FLEET COMPOSITION 50% EACH TYPE - UNRELATED
UNRELATED SPLIT FLEET COMPOSITION IN BALANCE WITH MARKET COMPOSITION
SINGLE FLEET 100% INTERCONTINENTAL
ASSUMPTIONS
LOAD FACTOR
ALL MEDIUM RANGE FLYING
50%
ALL LONG RANGE FLYING
SYSTEM MARKET COMPOSITION - % PASS. MILES LONG RANGE

A simplified study of a group of hypothetical airlines shows, on this graph, the influence of split-fleet operations on profit.

The Boeing family includes, at present, three basic models—the medium-range 720, the transcontinental 707-120 and the intercontinental 707-320. There are also powerplant and customer variations within each of these three members. With the 720 as the reference, the other two models have the following comparative characteristics:—

	707-120	707-320
Range (approx.)	+25%	+60%
Take-off weight	+25%	+50%
Structure weight	+4,000 lb.	+12,000 lb.
Empty weight	+8,000 lb.	+22,000 lb.
Passengers to break even ..	+15%	+35%
Wing area	Same.	+20%

A large degree of similarity is maintained in the structure of the three types. Fuselage cross-section has been kept identical, and much of the wing structure is similar apart from gauge changes. Structural layout and practices are similar so that the same flight-load survey and structural tests are, in general, applicable. Despite the use of different engines in the three models, much is common to the three powerplant installations, including the turbo-compressor, constant-speed accessory drive, starter and hydraulic pump.

In the hydraulic system, 90% interchangeability of components has been achieved; the figure for the fuel system is 75%. Lateral control surfaces on all models are identical, and the rudder, elevator and flap systems are the same or similar between one type and another. A survey of 1,005 normal spares items for 21 systems (including powerplant) shows 60% interchangeability, even between such dissimilar types as the 720 and the Conway-engined 707-420.

* "The Family Concept in Transport Design," by J. E. Steiner, assistant chief of preliminary design, Transport Division, given before the A.S.M.E. in New York on December 3, 1958; and "Design of Commercial Jet Aircraft for Specific Routes," by M. L. Pennell, chief engineer, Transport Division.

Need for Optimized Design

Turning to the operating aspects of the turbojet transports, both authors stress the importance of matching the range of the aeroplane with the average stage-lengths involved. Studies of a single multi-purpose design suitable for both North Atlantic and U.S. domestic operation leave serious doubts as to its efficiency. The effect on cost and profit for a medium-range operator using the "wrong" equipment has been calculated by Boeing as follows:—

	Transcontinental aeroplane	Intercontinental aeroplane
Increase in trip operating cost:	17%	37%
Increase in seat-mile cost:	7%	15%
Reduction in profit pass.-mile:	15%	28%
Reduction in profit/year/$ invested:	28%	45%

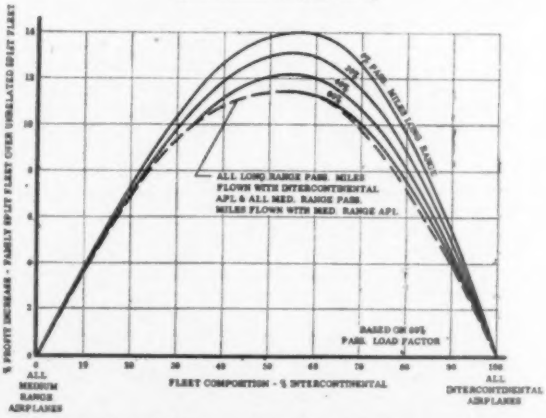
Hence the demand for the "right" aeroplane which has influenced Boeing's policy in developing their family of designs. It is worth noting, though, that the demand for a "small" aeroplane for routes where traffic density is low can be alternatively stated as a demand for a "low-cost-per-mile aeroplane," since spare capacity is always useful so long as the cost is not out of step with the traffic. Boeing claim break-even load factors of well below 50% for the Model 720 in most situations.

Whilst it is clear that operation of the wrong size of aeroplane on a given route can substantially increase costs, so also can the operation of a variety of different sized aeroplanes, because of increases in initial costs to the manufacturer, and in maintenance and training costs to the airline. In most cases, studies show, the higher costs of mixed fleet operation are more than offset by the savings due to such operation. For instance, an operator requiring some maximum-range aeroplanes can achieve overall savings of 12% to 15% if he can use a medium-range aeroplane on 50% of the routes, so long as traffic density is such that aircraft-mile rather than seat-mile costs are the controlling factor.

The effect of using a family of related types in favour of unrelated ones is shown on two curves reproduced here. The first is a very much simplified study of hypothetical airlines having various amounts of medium-range and long-range route structure and with different fleet compositions. It is clear that mixed fleet operation is more profitable, and "family" fleet operation is most profitable.

The second curve plots profit as a function of fleet composition and is again based on a series of route system studies comparing mixed fleet and "family" fleet operation. Penalties of split-fleet operation compared with a single-type fleet are seen to be greatest when the fleet is split equally into two—and it is at this point, as the curve shows, that most profit can be derived from using related aeroplanes. The improvement

(*Continued on page 371*)


% PROFIT INCREASE - FAMILY SPLIT FLEET OVER UNRELATED SPLIT FLEET
ALL LONG RANGE PASS. MILES FLOWN WITH INTERCONTINENTAL APL & ALL MED. RANGE PASS. MILES FLOWN WITH MED. RANGE APL
BASED ON 50% PASS. LOAD FACTOR
ALL MEDIUM RANGE AIRPLANES
FLEET COMPOSITION - % INTERCONTINENTAL
ALL INTERCONTINENTAL AIRPLANES

Profit is plotted here as a function of fleet composition to show the advantage of using related aeroplanes.

More power to the Victor

Now proved in flight, the R.A.F.'s new Victor B.2 bomber is even mightier than its speed-of-sound kinsmen already in squadron service.

Far-striking range, stratospheric performance and the great power of four Rolls-Royce Conway jets maintain for the Victor its place as the most formidable manned weapon in the skies.

HANDLEY PAGE

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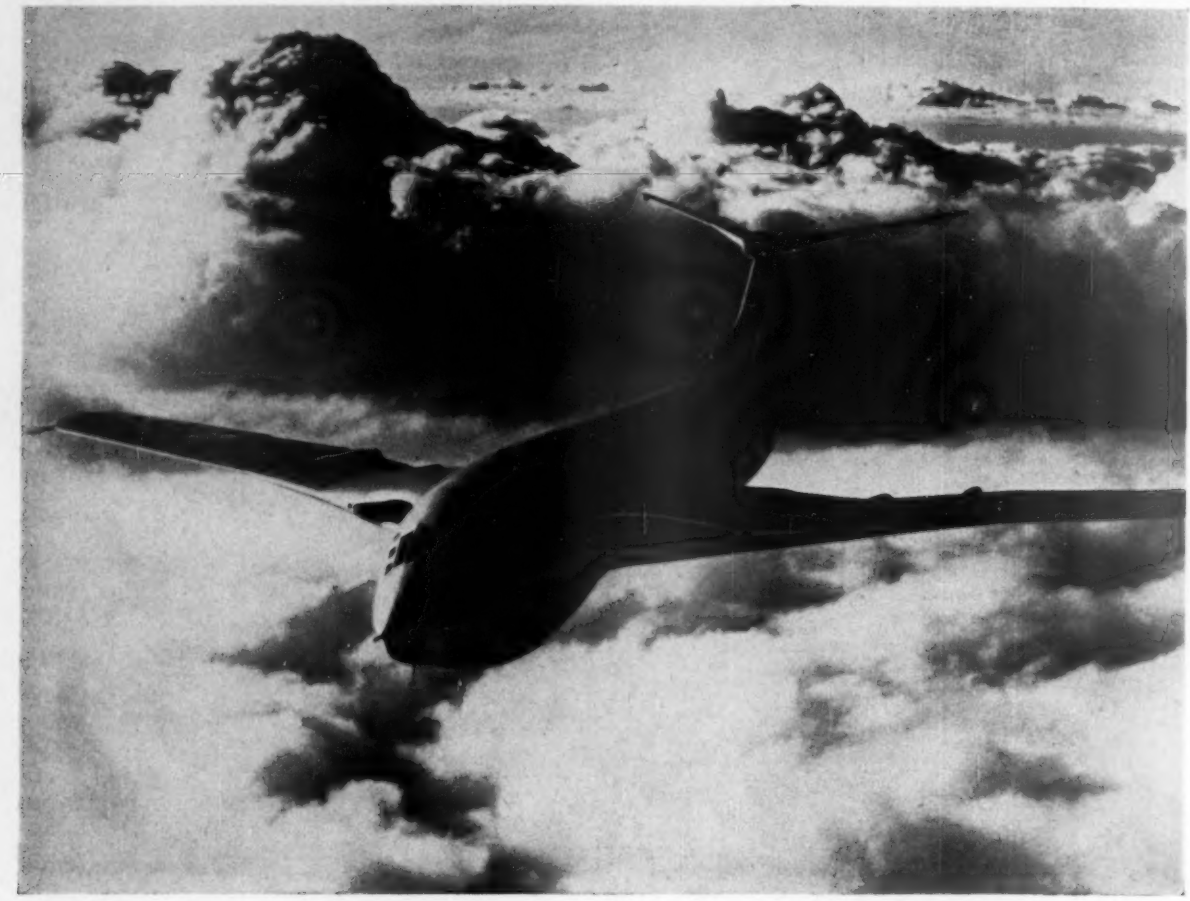


Unique performance of Victor B.1 rooted in **SAPPHIRE** efficiency

Praised by pilots for its superb response at high altitude . . . only aircraft of its size to have been dived transonically . . . holder of many other records . . . the Victor B.1 has the highest performance of any heavy bomber in the world. A performance rooted largely in its Bristol Siddeley Sapphire engines.

Sapphire efficiency proved by quantity production for vast number of aircraft

Outstanding efficiency of the Sapphire turbojet is confirmed by its use in a truly vast number of aircraft. Apart from the Victor B.1, Sapphire powers the Gloster Javelin all-weather fighter, Hawker Hunter Mk 2 and Mk 5, and many prototypes. In the United States well over 10,000 J65 Sapphires have been built under licence, equipping the Republic F-84F Thunderstreak and RF-84F Thunderflash, North American FJ-3 and FJ-4 Fury, Martin B-57 (Canberra) bomber, Douglas A4D-1 Skyhawk, Grumman F11F-1 and, again, many prototype aircraft.

Continued development, greater thrust

Current version of the Sapphire, the Sa 7, already delivers 11,000-lb thrust; while the simple reheat system developed for this robust and reliable engine now enables take-off thrust of 12,300 lb to be obtained.

Bristol Siddeley

ENGINES LIMITED

by as much as 11% could easily mean the difference between profitable and unprofitable operation.

Some airline studies have indicated that it is cheaper to use a long-range type on medium-range routes than to buy a new, unrelated type. Boeing have estimated that this could be true, for example, over two routes of 3,800 n. miles and 1,000 n. miles provided less than 30% of the passenger-miles are over the shorter stage, and assuming unrelated types. With two related types in this instance, however, the split-fleet would always be more profitable.

The effects of multiple type development on the manufacturer are significant, and include increased costs of very large magnitude and slower or more difficult schedules. On the other hand, a series of completely different aeroplanes would be even more expensive and difficult. Boeing studies of the effect of common engineering, common tooling, learning, etc., on the costs of successive groups of 75 each of the 707-120, 707-320 and 720 show that the last group costs only about 55% of the cost of a completely new design. But this same group of aeroplanes, had it been of the same design as the original group, would have cost only 40%.

The manufacturer must therefore be sure that diversification will bring about a reasonable increase in market size. The average unit cost of three types of related aeroplanes is higher than a single type but lower than three unrelated types. This is the kind of situation the manufacturer faces in deciding whether or not to add a new member to the family. Either way, "there is sufficient risk to keep any manufacturer's gambling instincts more than satisfied."

AFRICAN VIGNETTE

WEST African Airways Corporation (Nigeria), Ltd.—or more simply, Nigerian Airways—is a good example of the type of small airline operating, each with its own local problems, in all sorts of corners of the earth. Owned jointly by the Nigerian Government with 51%, the Elder Dempster Lines (with 32½%) and B.O.A.C. (with 16½%), it is almost a public utility in a country of relatively poor surface communications.

The feeder services which today are practically essential to daily life in Nigeria are inevitably unprofitable. Stratocruisers chartered from B.O.A.C. for the Lagos-London route wave the flag of prestige and probably break even, while the mainstay of the company's income is derived from its agency for major international airlines.

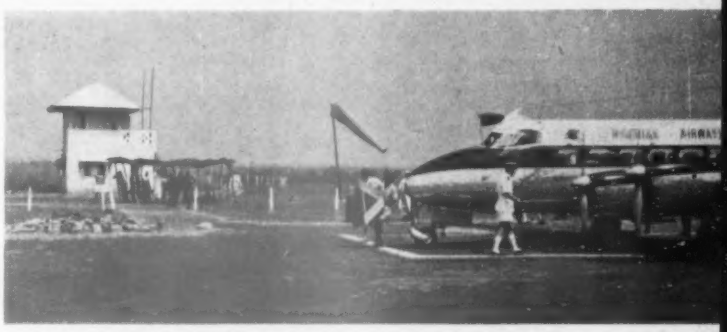
The internal fleet consists at present of about seven DC-3s and six Herons—both, incidentally, with an excellent safety record, the only fatal accident in 11 years of operations occurring on a service flight with a Heron two years ago. Most of the aircraft are based at Lagos, but two flights a day operate outwards from Kano, linking the Northern and Eastern Regions of Nigeria to one of the two international airports at least once a week.

Many of the smaller fields like Yola, Sokoto and Enugu come under the broad description of "bush," with comparatively primitive facilities which combine with Nigeria's erratic weather to introduce an element of "real" flying that appeals to pilots weary of overcrowded traffic areas and robot science.

Except for occasional lapses of timetable caused by the weather, Nigeria has the added attraction for aircrew that all internal flights are out-and-home in one day, night-landing facilities being available only at Lagos, Kano and one or two alternate fields like Kaduna. The main meteorological obstacles are rain during the wet season—which can waterlog some of the grass landing strips although it seldom affects a well-drained laterite runway such as Kaduna—and severe line squalls.

Apart from buffeting on the edge of a squall, the windspeed may on occasion be equal to, or even greater than, that of an aircraft; ample warning is normally available and avoiding action—usually around rather than over as the depth of the squall may be up to 30,000 feet—is essential. Not only aircraft are vulnerable; after diverting to Kaduna to dodge a squall one First Officer returned to Kano and discovered his car flattened under a dislodged roof of the airport building.

Stories of bush flying are legion. A typical recent one concerns the Heron making its weekly call at Yola, near the Cameroon border. Bell signals are rung to clear the runways on the approach of an aircraft, but on this occasion they were unheard or ignored by an African policeman who materialized out of the head-high grass on his bicycle and owes his skin to an overshoot. Arriving passengers at Kano may have seen the herald mounted on a camel, with a seven-foot bugle, who was provided by the Emir (to be maintained by the airport) with the same object of runway clearance in mind, whilst maintaining the tradition of heralding the arrival of caravans at the end of their Sahara crossing.



A de Havilland Heron of Nigerian Airways at Enugu, typical of the smaller fields served in Nigeria.

The episode of the Sea Vixen which crashed recently after a collision with a vulture during a test flight near Kano is more widely known, but not the sequel in which the navigator, having ejected and landed safely, then found a horse, rode off to look for civilization, fell and injured his back. Africa is indeed a treacherous place.

Fuelling is a significant factor in the economics of this kind of operation. Most of the more remote airfields are supplied by long-distance road transport, in many cases after an already long rail journey. The cost per gallon above Lagos price rises from 10d. at the railhead of Kano to 2s. 2d. at Maiduguri and a peak of 2s. 6d. at Yola, so that nice calculations are needed to make the best of the disposable load.

The Bristol 170s which were at one time in service with W.A.A.C., offering amongst other things a competitive freight charge for delivering new cars to the North, were disposed of some months ago. Negotiations, which may not be disclosed, are in hand to buy replacements for the present fleet. So far as the aircrew are concerned the answer generally seems to be one which has been heard in other places: "Won't somebody build us some new DC-3s?"

R. BENSTED-SMITH.

Another scene at Enugu, with two Dakotas in front of the "terminal building," and the manual refuelling equipment in the foreground.

Photographs copyright "The Aeroplane"

Handley Page Victor—

development of a crescent-winged V-bomber

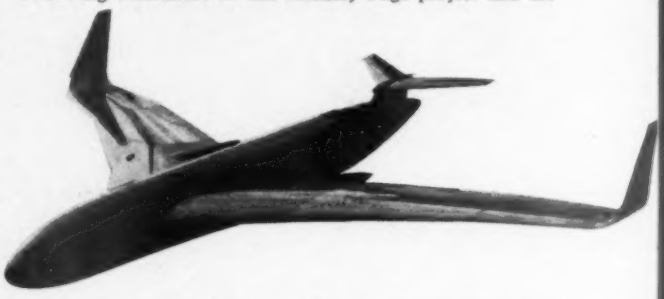
IT is not widely known that the specifications for Britain's V-bombers were based partly on a pioneer proposal for a four-jet bomber made in 1946 by Handley Page. Mr. G. H. Lee, now Handley Page deputy chief designer, went to Germany late in 1945 to investigate wartime German research into swept-wing aircraft. Based on his conclusions the company submitted a study for a high-speed long-range four-jet bomber to the Air Ministry in June, 1946.

This was not the first Handley Page project for a jet bomber; there were earlier schemes for tailless aircraft. But, as submitted to the Air Ministry, the aircraft represented a compromise between the tailless configuration and a conventional layout. It had a 45° swept wing with fins and rudders at the wing tips and elevon controls. These elevons were intended to move upwards automatically to counterbalance flap pitching moments. Longitudinal control power was increased by a small all-moving tailplane mounted above a stub fin. Fully duplicated power controls were planned from the start.

The projected aircraft had four jet engines buried in its wing root and its all-up weight was 90,000 lb. The range was to be 5,000 miles with a load of 10,000 lb.; the cruising speed was 520 m.p.h. at 50,000 ft. Power was supplied by four Rolls-Royce axial-flow turbojets based on type A.J.65; each was to give 5,600 lb. static thrust at sea-level.

The aircraft had a span of 122 ft., a length of 92 ft. and a height of 21 ft. Its 45° swept wing was 16% thick at the root and 9% thick at the tip. Fuel load was 4,600 gal.

Following assessment of this Handley Page project and the reports of the teams which had investigated German research during the 1939-45 War, the Air Staff formulated an operational requirement which led in due course to the V-bombers. The specification was issued on January 1, 1947, and called for a bomber of outstanding performance. The new aircraft had to be two and a half to three times more effective than contemporary bombers in terms of altitude, speed and range, according to a later ministerial statement.



CRESCENT-WINGED MODEL.—This low-speed wind-tunnel model represents the Victor design-development stage reached in 1947.

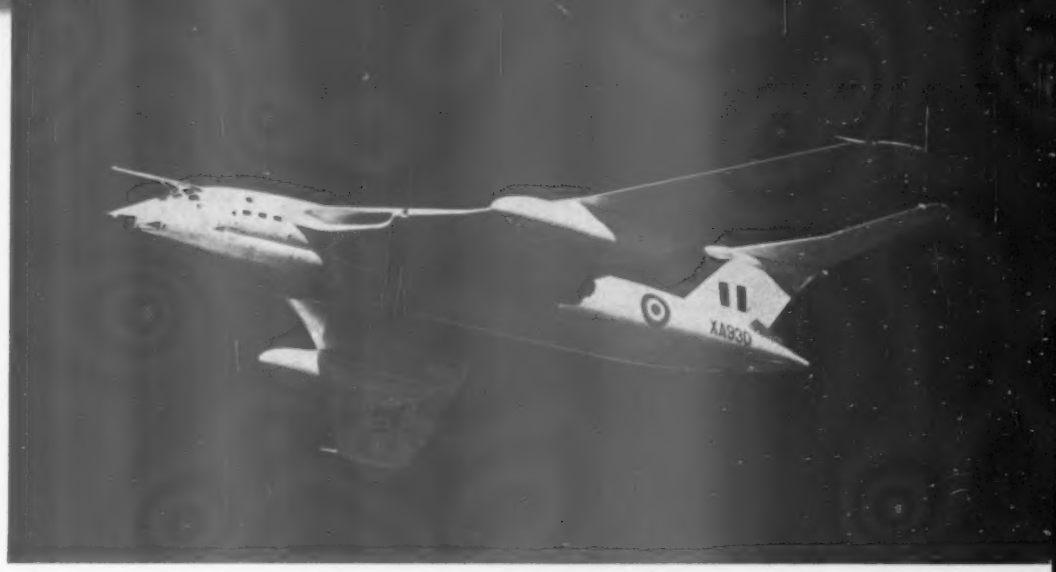
This vague description has been variously interpreted, but the known performance of the V-bombers suggests that a cruising speed approaching 600 m.p.h. and an operating altitude of about 50,000 ft. were specified. These were exacting requirements in the days when the piston-engined Lancaster was Britain's leading front-line bomber.

Handley Page project teams were set up by Mr. R. S. Stafford, now the company's technical director, to evolve a design to meet this specification. Mr. C. F. Joy, now Handley Page's chief designer, led the airframe design group, while Mr. G. H. Lee was responsible for the aerodynamic team.

Basic studies suggested that a moderate wing loading was necessary and that the wing should have a fairly large span. These features were needed to give low drag for long-range flight and a good high-altitude performance. Considerable sweepback was needed to achieve the specified critical Mach number while using a wing with a practicable thickness/chord ratio.

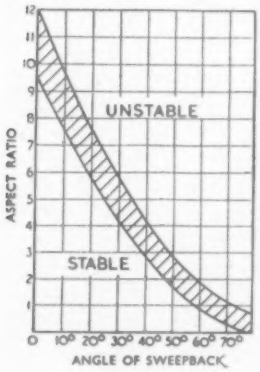
Project designers at Handley Page had been working continuously on the design of the H.P.80—as the aircraft was called which developed from the original projects and in due course

LATEST VICTOR.—Clearly evident in this view of the Rolls-Royce Conway-engined Victor B.2 are its extended wingspan and larger air intakes.



LONG RANGE.—The flight-refuelling probe and large underwing tanks on this Victor B.1 indicate how the range of this V-bomber is to be extended.

became the Victor. As more design experience was gained, it became clear that the requirements for high sweep and a high aspect ratio were incompatible if tip stalling was to be avoided. Tip stalling causes pitch-up and longitudinal instability.



TIP STALLING.—The relationship between a wing's aspect ratio and its sweepback influences tip stalling and affects stability. This graph represents the state of the art when the Victor was designed; leading-edge droop on wing sections allows a somewhat better performance to be achieved today.

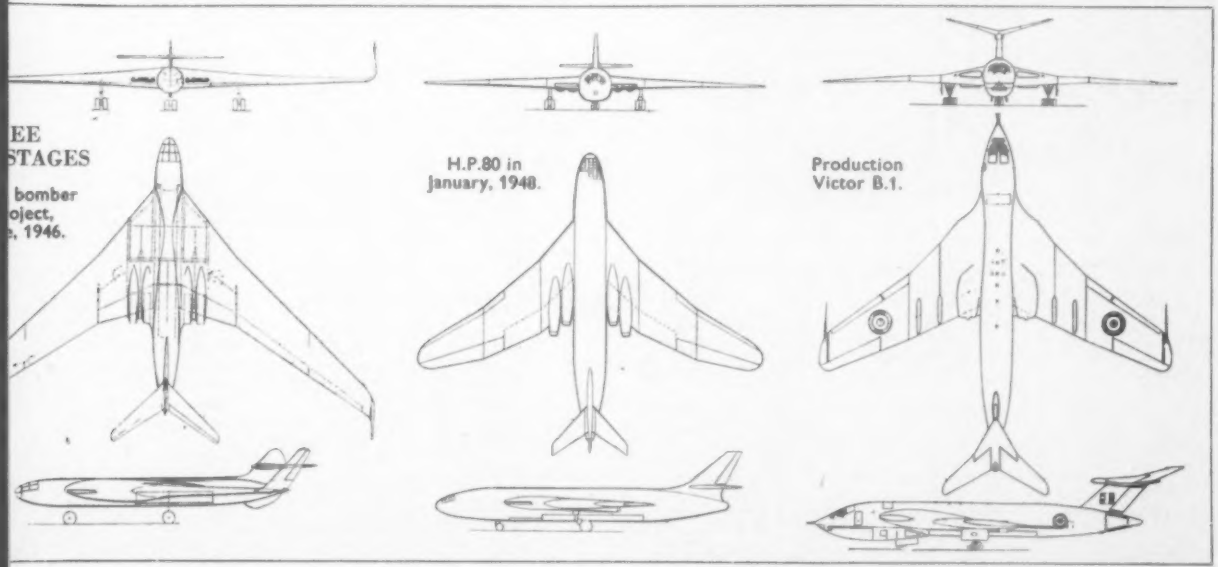
An accompanying diagram shows how longitudinal stability varies with different combinations of aspect ratio and sweepback angle. The combination of aspect ratio and wing sweepback needed for the H.P.80 would have put the wing into an unstable region if a straight-swept wing had been used.

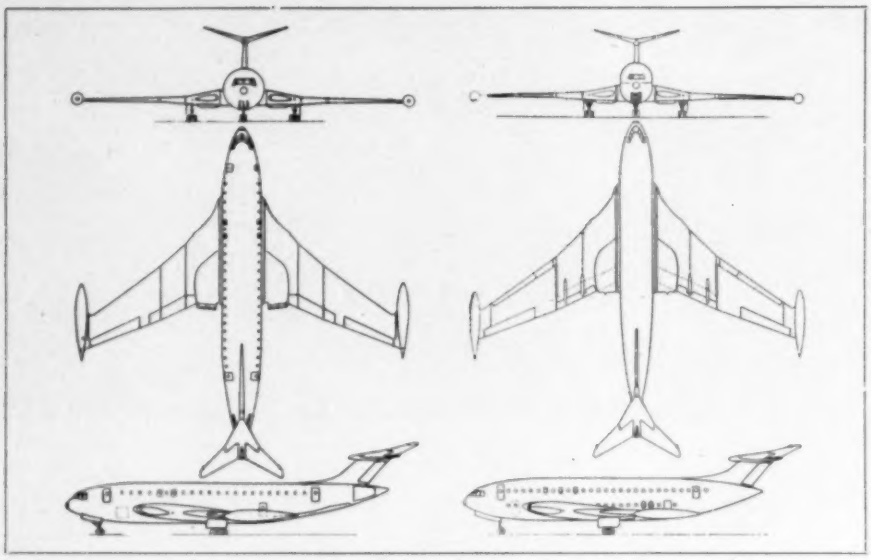
A highly-swept high-aspect-ratio wing stalls at its tips because the local lift coefficient is highest there and also because of boundary-layer outflow. Over the rear of the wing the boundary layer moves from the root towards the tip and tends to delay the stall at the root while accelerating tip stall.

It was this tip-stalling problem which led to the adoption of the crescent, or variable sweep, wing for the Victor. It was chosen as a compromise between the design requirements for good performance and those for avoiding tip stall. Aspect ratio was chosen to give a good range performance.

Wing sweep was progressively reduced towards the tip, with

FULL-SCALE MODEL.—The H.P.88, which flew in 1951, had a Supermarine Attacker fuselage and a wing and tail unit representative of the H.P.80 design in early 1948.





VICTOR-BASED PROJECTS.—These projected aircraft, both based on the Victor B.2, are (right) the Civil Victor jetliner of 1957 and the H.P.111 military and strategic freighter of 1958/9.

the inner wing highly swept so that it could be made thick enough to allow a low structure weight and to permit stowage of engines and undercarriage. Near the tip the wing was much thinner, and its reduced sweep had a beneficial effect on tip stall. Over the whole wing, thickness and sweep were adjusted so that the critical Mach number was reached simultaneously at all points along the span.

Although simple in concept, design development of the Victor's crescent wing was a long and arduous process, involving several changes and much high- and low-speed tunnel testing. This was done in the company's own low-speed tunnel and in the high-speed tunnels of the R.A.E.

In late 1947, Handley Page received a design contract for the H.P.80; it was to be powered by four MetroVick F9 engines of 7,500-lb. thrust each. This engine, later known as the Sapphire, was developed by Armstrong Siddeley. A prototype order for the H.P.80 was given in 1949, but production aircraft were not ordered until late in 1952.

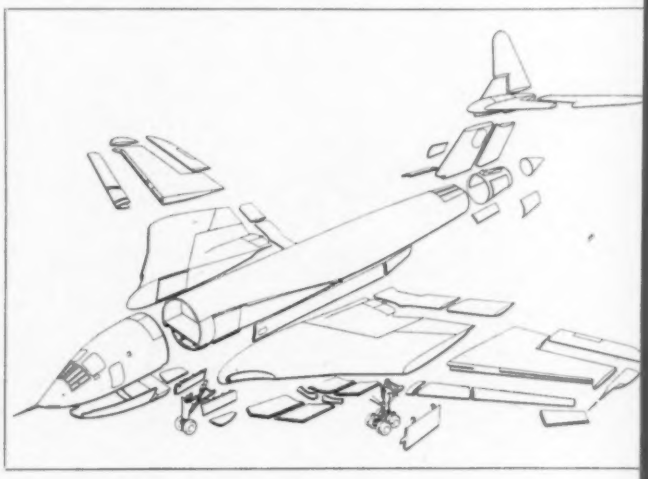
When it was ordered, the H.P.80 had a crescent wing on which each semi-span had three angles of sweep, with the changes of sweep, or "kinks," equally spaced. Fins and rudders were still mounted on the wing-tips, but this feature was soon abandoned because it had a bad effect on tip stalling. A single large central fin and rudder was then introduced with the tailplane above it.

The next stage was a doubling in size of the tailplane, which eliminated the need for the ailerons to act together as elevons when the flaps were lowered.

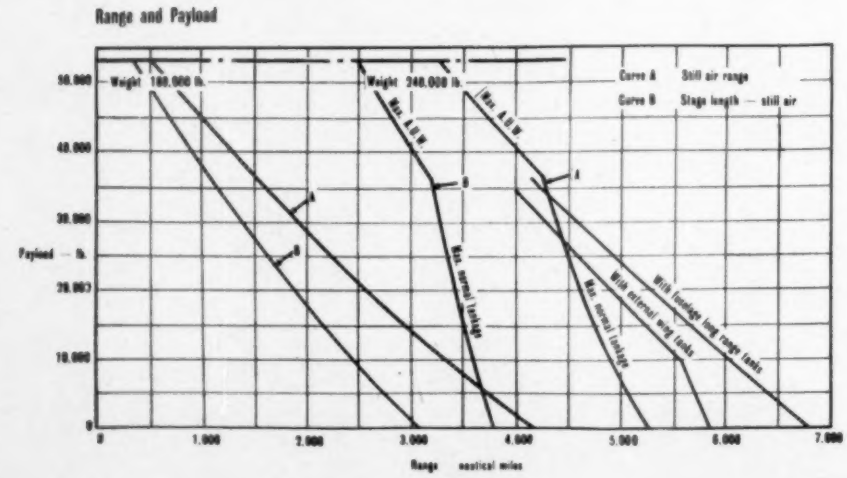
To gain flying experience with the crescent wing a research aircraft was built with a wing and tail unit which were scale models of those to be used on the Victor.

This aircraft, the H.P.88, had a Supermarine Attacker fuselage. Its detail design and construction were carried out at Brough by Blackburn and General Aircraft, Ltd. It was

(*Continued on page 375*)



PRODUCTION ASSEMBLIES.—Above, the break-down of the Victor B.1 into assemblies for production.



VICTOR B.2 PERFORMANCE.—H.P.111 range-payload performance, shown here, indicates the Victor B.2's potential. The Victor, with its low-drag fuselage, undoubtedly has a higher performance.

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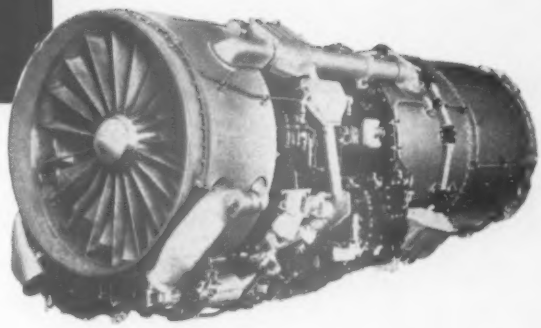
CONWAY
BY-PASS TURBO JETS



power the
HANDLEY PAGE
VICTOR B.MK. 2
for the
ROYAL AIR FORCE

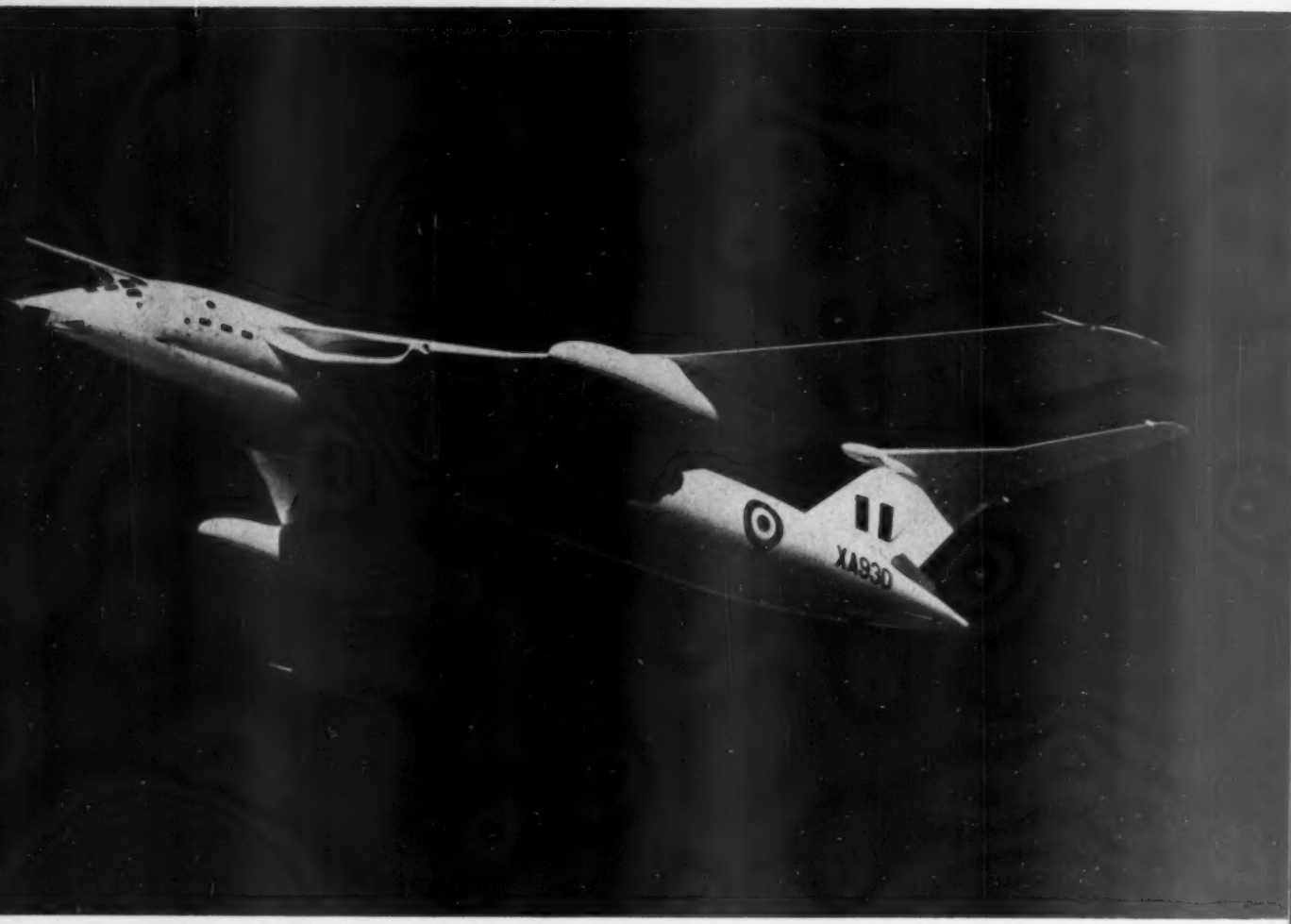
The by-pass principle, proved by Rolls-Royce in the Conway, is now accepted as the correct formula for certain military applications and for all jet transports.

ROLLS-ROYCE LIMITED, DERBY, ENGLAND

AERO ENGINES · MOTOR CARS · DIESEL AND PETROL ENGINES · ROCKET MOTORS · NUCLEAR PROPULSION

in the airframe and engines of The

HANDLEY PAGE VICTOR



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as Castings, Extrusions, Forgings and Sheet

HIGH DUTY ALLOYS LTD. SLOUGH, BUCKS

(*Continued from page 374*)

intended that design data for the Victor would be given by H.P.88 flight tests, but the aircraft did not fly until the middle of 1951, by which time the Victor prototype was being built.

The H.P.88 had a short career; it crashed in August, 1951, following a structural failure when it was making a high-speed run over Stansted Aerodrome. The aircraft had power-boosted controls with a balance weight in the circuit. During the high-speed run a slight longitudinal oscillation was caused, possibly by a bump. In attempting to correct this the pilot may have "chased" the oscillation; this is not certain, but in fact the oscillation built up to the point where the fuselage was over-stressed and failed.

Continued Development

The next Victor design changes followed high-speed tunnel tests which showed that the drag rise came earlier than was required. To improve the drag-rise speed, the thickness chord ratio of the wing was reduced over its outer section by about 2%. There was also a progressive increase in the wing chord at the fuselage side to give more stowage space for engines and undercarriage.

Increase in root chord and the thinner outer wing had a bad effect on tip stalling and an intensive programme of tests in the Handley Page low-speed tunnel was started to put this right. As a result of this work the wing planform was changed: the outer changes of wing sweep, or "kinks," were moved inboard from the 2/3-semi-span point to the half-semi-span point; and the tip chord was increased, changing the taper ratio from just over 4 : 1 to about 3 : 1.

Nose flaps were also added over the outer half of the span. Another change at this stage was the addition of dihedral to the tailplane to improve directional stability.

An additional device was fitted to the wing to improve tip-stalling. This was a "contra-flap" — a trailing-edge flap which opened both below and above the wing and was installed between the landing flap and the aileron. Tunnel tests showed that these flaps gave better control over boundary-layer outflow. Flight tests showed, however, that "contra-flaps" were unnecessary and although fitted on the Victor prototype, they were never used.

The changes made to the wing allowed the specified high critical Mach number to be achieved and also gave good stalling characteristics at low speed. The Victor configuration reached this stage at the end of 1951 and has changed only very slightly since.

Structural Considerations

Although this account is primarily concerned with the aerodynamic development of the Victor, it should be borne in mind that the aircraft's success depends as much on its structure. The main feature of this is the spot-welded sandwich construction developed by Handley Page.

Details of the Victor's structure were given in THE AEROPLANE on September 5 and December 12, 1958, and a fully detailed cutaway drawing of the Victor B.1 which appeared in the latter issue is reproduced on page 376.

Flight Development

The prototype Victor made its first flight on December 24, 1952, from Boscombe Down. It was flown by Sqn. Ldr. H. G. Hazelden, the company's chief test pilot.

Flight development went smoothly until July 14, 1954, when this aircraft crashed during a low-level position-error run at Cranfield. A minor fatigue failure reduced the structural stiffness of the tail unit slightly; as a result there was tail-unit flutter and the tailplane came away from the airframe. Following this accident the tail-unit stiffness was doubled and before the Victor's entry into service, in-flight flutter trials were made which cleared it up to the design diving speed.

The second prototype Victor flew on September 11, 1954, and was followed 16 months later, on February 1, 1956, by the first production Victor B.1. There were slight external differences between the prototypes and the production aircraft; the main one was a 40-in. increase in the length of the nose fuselage, which was introduced for C.G. reasons. Another change was a 15-in. reduction in the height of the fin.

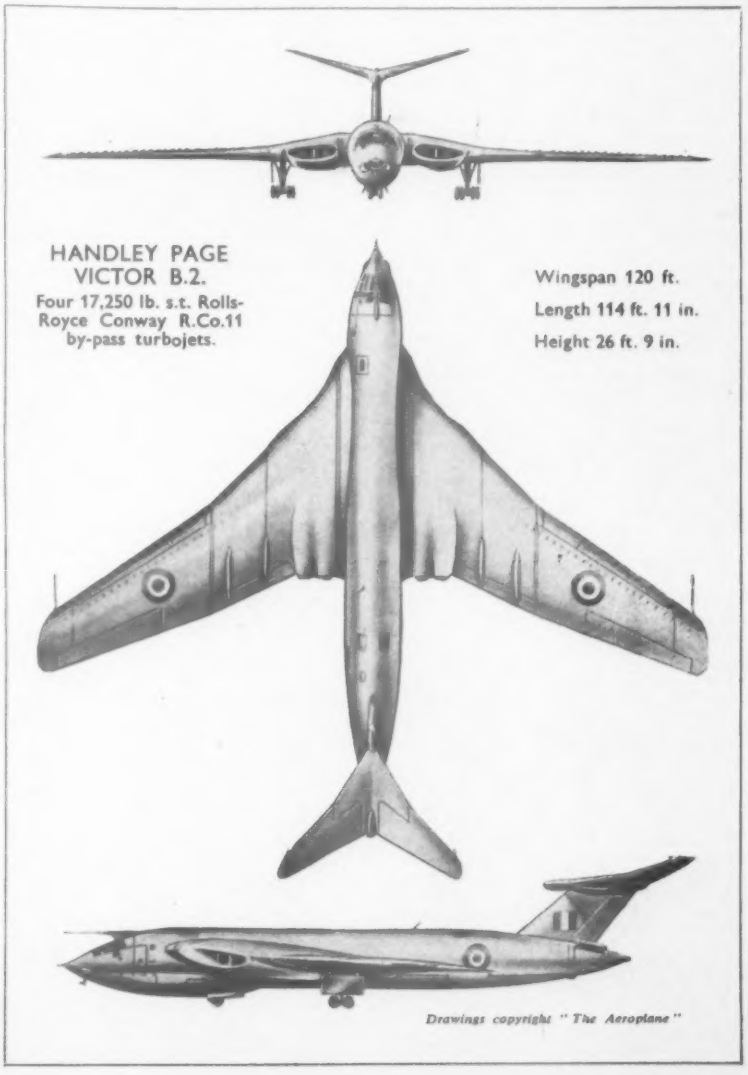
Apart from the hold-up when the first prototype was lost and a natural caution about flutter, the flight development of the Victor went smoothly and assessment reports by Boscombe Down teams spoke highly of the aircraft. It was felt that the Victor had supersonic capability and Area-rule calculations indicated that—purely fortuitously—the Victor had a reasonable cross-sectional area distribution for transonic flight.

The flight-test programme of necessity concentrated on clearing the Victor for its specified performance, but in June, 1957, during high-speed trials the aircraft reached a corrected Mach number of 1.02 in a shallow dive. The Conway-powered Victor B.2, with about 57% more thrust, may possibly be able to fly level at supersonic speed, although its thrust margin will probably be so slight that such a performance will have no operational value.

Victors in Service

Deliveries to No. 232 O.C.U. at R.A.F. Gaydon began in November, 1957, and the aircraft went into service in the spring of 1958, with No. 10 Squadron at R.A.F. Cottesmore, No. 15 Squadron at Gaydon also has Victors now and a reconnaissance version of the aircraft is in service at R.A.F. Wyton.

Aircrew reactions to the Victor were given during a Press visit to Cottesmore last September. The aircraft is obviously


HANDLEY PAGE
VICTOR B.2.
Four 17,250 lb. s.t. Rolls-Royce Conway R.Co.11 by-pass turbojets.
Wingspan 120 ft.
Length 114 ft. 11 in.
Height 26 ft. 9 in.
Drawings copyright "The Aeroplane"

popular with its crews; it is said to have better speed and handling characteristics at altitude than the other V-bombers and also better approach and landing behaviour. It also gives a better all-round view for its crews and has the largest V-bomber flight-deck. All five members are seated at almost the same level, an arrangement which is better liked than the dispersed layout of the other V-bombers. As to its altitude performance, an Air Ministry statement says that "at its operational height this bomber can outfly and out-manœuvre any fighter in service today." As mentioned in THE AEROPLANE last week, the Minister of Supply has implied that on occasion Service pilots fly the aircraft supersonically.

Victors are to be equipped with probes for air-to-air refuelling and very large underwing fuel tanks can also be fitted. For overload take-offs, two jettisonable rocket packs are to augment thrust—each will contain a de Havilland Spectre rocket motor and its propellent tanks.

Little can be said about the Victor's rôle as a strategic bomber, but the Secretary of State for Air has revealed that all V-bomber squadrons practise the technique of getting six aircraft airborne within six minutes of a signal being passed to their crews. The effectiveness of the Victor as a strategic bomber will be increased when Mk. 2 aircraft enter service; these will carry the stand-off bomb.

In the reconnaissance rôle Victors use radar techniques. With current equipment, reconnaissance pictures allow airfields to be identified and their runways to be measured accurately. With later equipment which is being developed for the Victor, a single aircraft could cover an area equal to the whole of the Mediterranean in one sortie; the accuracy will be such that all the ships in the area can be counted. It is planned to re-equip the R.A.F. reconnaissance force with Victor 2s.

Developed Victor

The Victor B.2 made its first flight on February 20 this year. This aircraft has four 17,250-lb. thrust Rolls-Royce Conways, giving it considerably more than half as much thrust again as the Sapphire-engined Victor B.1. Externally the aircraft are similar in appearance, their length and height being the same. The wing span of the Victor B.2 is 10 ft. greater than that of the earlier Victor; the increase comes from a stub-wing extension at the fuselage sides and increased-span wing tips.

Although these Victors are similar in appearance, there is no doubt a great difference in their performance. Victor B.2 operation at altitudes around 60,000 ft. is probable and, as already mentioned, this aircraft may be capable of supersonic level flight.

An indication of its performance—albeit a very pessimistic one—is given by the range-payload graph for the H.P.111 shown on page 374. It should be borne in mind that the H.P.111, although based on the Victor 2, is a transport aircraft with a large, heavy, high-drag fuselage which will give it a much worse range performance than the Victor 2.

With future air-to-surface missiles of increasing range, attacks can be launched from the least-expected direction if the missile carrier has a large radius of action. This suggests that future stretch of the Victor will aim at extending its range; this trend is already apparent in the use of air-to-air fuelling and giant underwing tanks.

Victor-based Projects

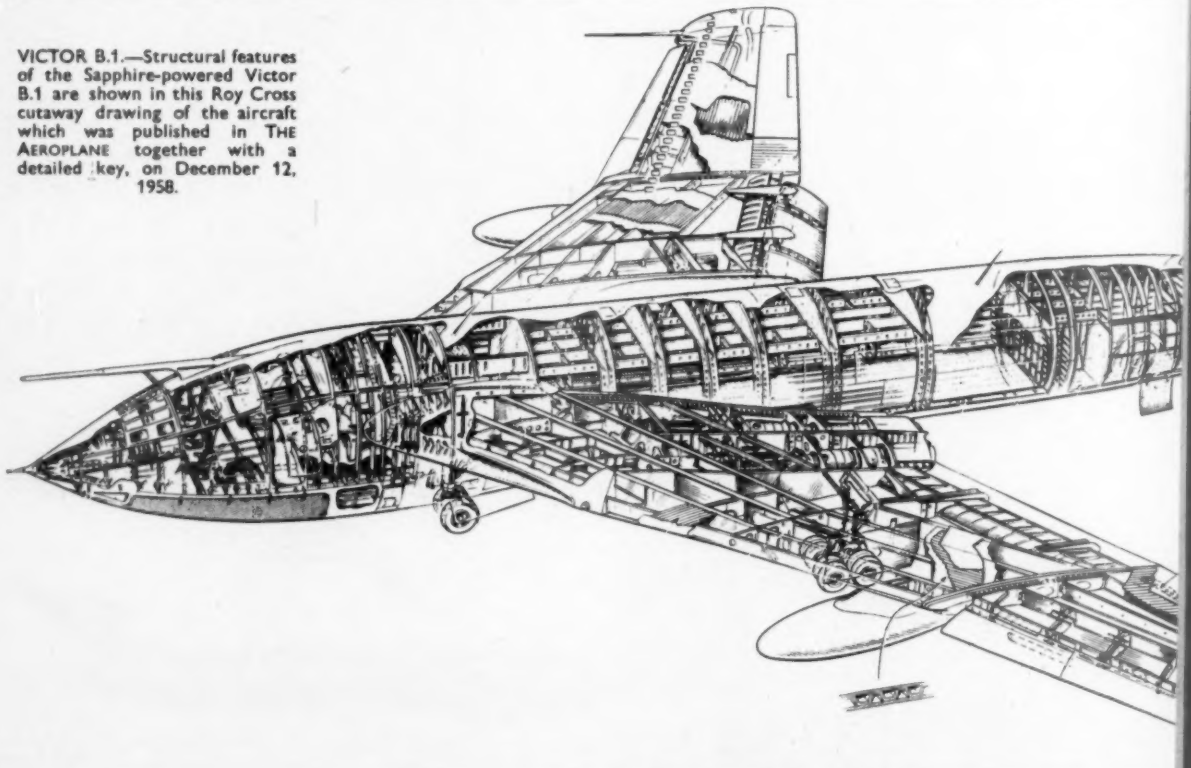
In various guises, Handley Page projects based on the Victor have appeared since 1952. The first was the H.P.97, a trans-atlantic airliner aimed at B.O.A.C. This aircraft was in effect a Victor 1 with a large double-bubble fuselage.

The next airliner version to be announced was the Civil Victor of 1957. This aircraft, in effect a Victor B.2 with a large double-deck fuselage, was in competition for the B.O.A.C. order which eventually went to the Vickers-Armstrongs V.C.10. It had an all-up weight of 214,000 lb. and a cruising speed of more than 600 m.p.h.; maximum payload was 40,000 lb.

The most recent and most ingenious of the projects based on the Victor 2 was the H.P.111, a competitor for the strategic-transport order recently awarded to the Short Britannic turbo-prop freighter. Details of the H.P.111 were given in THE AEROPLANE of August 22, 1958.

It was intended to cruise at 545 m.p.h. over long ranges as a strategic freighter, while as a tactical transport it would operate into 1,000-yd. grass strips. In the strategic rôle its all-up weight was to be 240,000 lb.; as a tactical aircraft it would operate at the reduced all-up weight of 180,000 lb. Blown flaps as well as a braking parachute and airbrakes were to be used for landing in the tactical rôle.

Although the basic design of the Victor dates back several years, the Minister of Supply has said that Victors are likely to be in service with the R.A.F. for 10 years. The aircraft has justified the faith of its designers in the crescent-wing concept and although the crescent versus delta controversy is now a thing of the past, there seems little doubt that the crescent-winged Victor is at least as effective, if not more so, than any other V-bomber.—J.R.C.



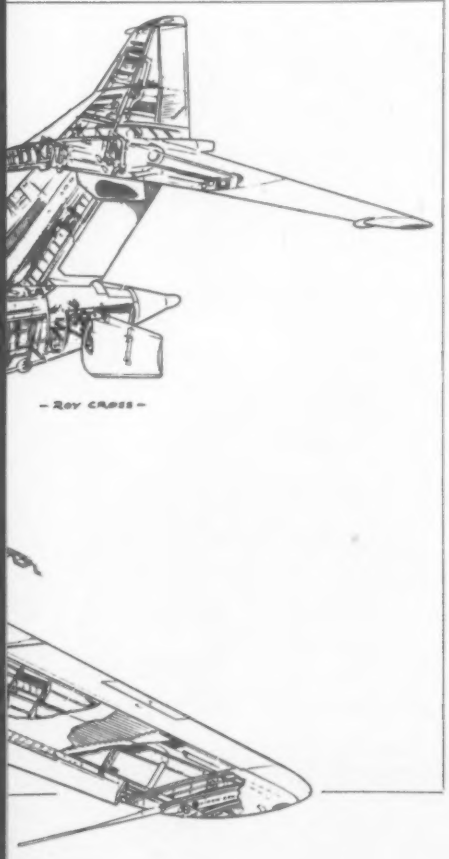
VICTOR B.1.—Structural features of the Sapphire-powered Victor B.1 are shown in this Roy Cross cutaway drawing of the aircraft which was published in THE AEROPLANE together with a detailed key, on December 12, 1958.

STRATEGIC PARADE. — These Handley Page Victor B.1s of No. 10 Squadron, Bomber Command, are based at R.A.F. Cottesmore.

CONTRIBUTORS TO THE VICTOR'S SUCCESS

MANY equipment suppliers have played their part in making the Victor the effective deterrent weapon it is today. The information below gives some idea of the widespread industrial effort involved in producing a V-bomber, although the list is of necessity incomplete. It would be almost impossible to compile a comprehensive list including every company associated to a greater or lesser degree with the Victor.

All but two of the companies listed below have been named by Handley Page as being among the principal suppliers for the Victor B.1 and have given the information on their contributions to the Victor. Also listed are two companies associated particularly with the Victor B.2.



Aero Controls, Ltd.—Universal joints in the flap-control system.

The Airscrew Company and Jicwood, Ltd.—Single-stage 4-h.p. centrifugal fan, 6 in. in diameter, for ground cooling of aircraft equipment.

Bloctube Controls, Ltd. — Mechanical controls.

Bristol Siddeley Engines, Ltd.—A.S.Sa.7 Sapphire turbojets for the Victor B.1. The Sapphire has a 13-stage axial-flow compressor, an annular combustion chamber and a two-stage axial turbine. The engine weighs 3,050 lb., has a maximum thrust of 11,000 lb. and an s.f.c. of 0.88 lb./lb./hr.

James Booth and Co., Ltd.—Duralumin extrusions, tubes and sheets for the airframe.

The British Thomson-Houston Co., Ltd.—Control and switchgear; electric motors for the electro-hydraulic powered flying-control units produced by H. M. Hobson, Ltd.

British Messier, Ltd.—Hydraulic equipment for the 4,000 p.s.i. system—about 100 separate units are supplied.

de Havilland Propellers, Ltd.—Turbo-fan cold-air unit for the Victor B.1 cabin air-conditioning; the unit can reduce an airflow of 75 lb./min. from 300° C. to 0° C. For the Victor B.2 an air-conditioning pack has been developed which supplies about 5 lb./min. of air, at a suitable temperature and humidity, to ventilated suits for crew members.

Dowty Equipment, Ltd.—Button switches and undercarriage indicators, limit switches, stepless control system, two- and three-position indicators, lever switches for various applications.

Dunlop Rubber Co., Ltd., Aviation Division.—Tyres, wheels, brakes, Maxaret anti-skid units, windscreen wipers, inflatable air-intake seals of neoprene rubber reinforced with glass fabric.

Dzus Fastener Europe, Ltd.—Aircraft fasteners.

Electro-Hydraulics, Ltd.—Main and nose-wheel undercarriage units. Main units have a balanced bogie with four small-diameter wheels, each having two tyres. The twin-wheel nose undercarriage unit can be power steered through ± 45° and is freely castoring through ± 90°. The complete undercarriage weighs 3% of the Victor's all-up weight.

Elliott Brothers (London), Ltd.—Mk. 3 flowmeter system, Mk. 2 accelerometer.

English Electric Aircraft Equipment Division.—Constant-speed AC electrical generation system for the Victor B.2.

Fireproof Tanks, Ltd.—Flexible wing and fuselage fuel tanks in 0.020-in.-thick Hycatrol sheeting with a white inner Hycatrol lining which allows for the detonation of explosion-suppression units. Tanks are tailored to fit their respective tank bays and held in position by spring-loaded colletted studs which are vulcanized to the tank skin and engage with holes in the tank-bay lining.

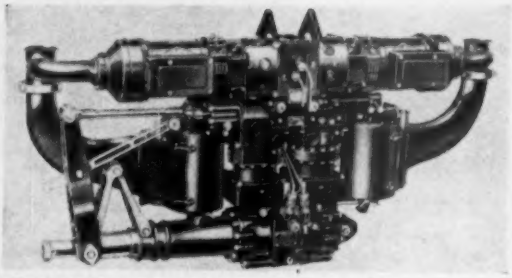
Flight Refuelling, Ltd. — Mk.6 probe nozzle for flight refuelling by the probe-and-drogue technique; float switches which control the upper shut-off level of fuel in the tanks during pressure refuelling by closing Mk.38 refuelling valves; float switches for low-level indication in fuel tanks and hydraulic reservoir; non-return valves of various sizes; 2¼-in. self-sealing unit which forms the aircraft adaptor half of a pressure-refuelling coupling.

G.Q. Parachute Co., Ltd.—Ring-slot braking parachute with a flat diameter of 45 ft.—said to be the largest braking parachute in service in Britain and one of the largest in the World.

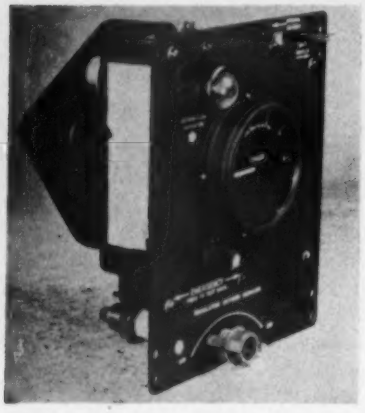
Sir George Godfrey and Partners, Ltd.—Flow-augmentor and flood valve for cabin pressurization system; turbo-fan cold-air unit on Victor 2; vapour-cycle pack for equipment cooling.

Graviner Manufacturing Co., Ltd.—Firewire fire-detection systems; fire-extinguisher bottles in the wing and engine bays; explosion protection system for fuel tanks; inertia switch for crash fire-protection; hand fire-extinguisher in the crew cabin.

POWER CONTROLS.—Right, Hobson electro-hydraulic units are used for the Victor's powered flying controls; this is the type 149 rudder unit.



OXYGEN REGULATOR.—Below, Normalair, Ltd., supply this demand regulator for aircrew oxygen.



High Duty Alloys, Ltd.—Forgings and castings in Hiduminium alloys which include sand-cast stator casings for the Sapphire engines, die forgings for upper spar boom, undercarriage forgings for Electro-Hydraulics Ltd., and hand-forged spar plates.

H. M. Hobson, Ltd.—Electro-hydraulic power control units for all primary flying control surfaces; fuel-flow proportioner units.

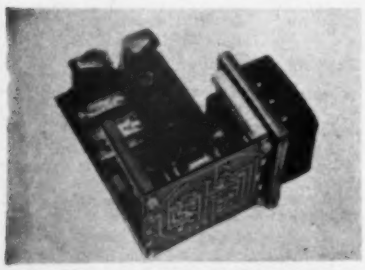
King Aircraft Corporation.—Vee-band clamp equipment for fuel and hot-air systems, toggle fasteners, high-strength shear fasteners.

Joseph Lucas (Gas Turbine Equipment), Ltd.—Combustion and fuel systems.

Northern Aluminium Co., Ltd.—Aluminium-alloy sheet and coil alloys in Noral M75S (DTD634), Noral M75S (DTD 687) and Alclad B26S (L72) and Alclad B26S (DTD5020) strong alloy plate; rectangular rod and bar in Noral B26S (BSL65) and Noral B75S (DTD5054).

Normalair, Ltd.—Equipment includes a cabin-pressure controller and a combined valve unit containing two discharge valves and two inwards-relief valves in a common casing. Also double-flap non-return valves of varying sizes, a coupling for cooling air, a ground pressurizing connection and a demand regulator which provides a controlled supply of oxygen to the aircrew.

The Plessey Co., Ltd.—Type 4 de-icing controller which maintains a constant windscreen temperature; high-temperature plugs and sockets; Squirrel rotary actuators of 50 lb. in. output torque; Plessiflex stainless-steel flexible hose for low-pressure air starter connections, engine-compressor bleed, and fuel-system and fire-extinguisher hoses; UHF transmitter/receiver.



DE-ICING CONTROLLER.—Printed circuits are used in this type 4 Plessey de-icing controller.

Rolls-Royce, Ltd.—Conway R.Co.11 by-pass engines, type-tested at 17,250-lb. thrust, for the Victor B.2, which is the first production aircraft to fly with this engine.

Rotax, Ltd.—Electrical generating and starter systems which include 73-kVA. alternators, transformer/rectifier units, inverters, control panels, compounding units, high-energy ignition units and various types of switchgear. Also linear actuators for aileron and rudder trimming, and rotary actuators for hydraulic pumps.

Rotol, Ltd.—Fuel-flow proportioners which allow for air-to-air refuelling, plus their associated equipment.

L. A. Rumbold and Co., Ltd.—Sound-proofing and thermal insulation, cockpit upholstery, standard and special crew seats, welded structures, anti-flash curtains, crash pads and prone cushions.

Sangamo Weston, Ltd.—Voltmeters, ammeters, frequency meters, power indicators and instruments for indicating pressure and air and jetpipe temperature.

Saunders Valve Co., Ltd.—Electrically operated non-return valves for pressure-refuelling system, electrically operated coupled vent valve and Axi-flow valve for 4,000-p.s.i. nitrogen.

Self-Priming Pump and Engineering Co., Ltd.—Fuel booster pumps, non-return valves and release valves.

J. Stone and Co. (Charlton), Ltd.—Producers of castings in aluminium, magnesium and copper-base alloys.

Smiths Aviation Division.—Autopilot; Smiths flight system; Smiths Waymouth fuel-contents system; flight, navigation and engine instruments.

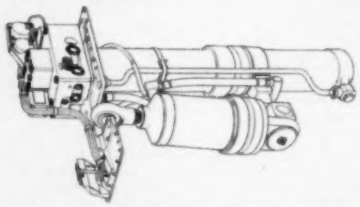
Teddington Aircraft Controls, Ltd.—Pressurization system for flexible fuel tanks in which a master control-valve senses the pressure differential and controls tank pressure by operating vent valves and compressed-air or nitrogen-supply valves; temperature airflow control valves for cabin air; ice-warning system; hot-air and cold-air valve which is controlled by sensing elements in air ducts—this meters the mixture of hot air tapped from the engine and cold ram air which is ducted to the wing and tail-unit leading edges for ice protection; equipment for bomb-bay heating and temperature control and for rudder-bias control.

Thermal Control Co., Ltd.—Firetec fire-detection system; pressure-operated switches.

Tiltman Langley, Ltd.—Specialized equipment.

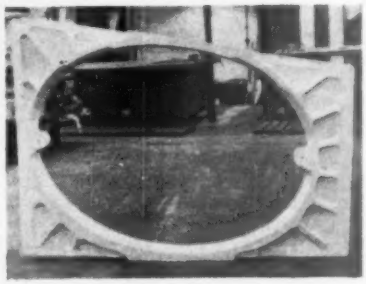
Titanine, Ltd.—White anti-flash paint.

Vickers-Armstrongs (Aircraft), Ltd.—Fuel-system accessories.

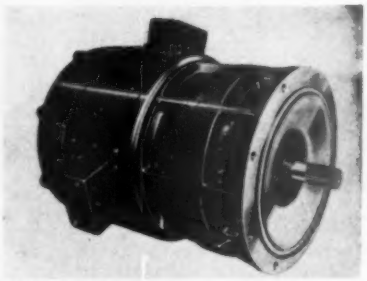


NOSE-FLAP UNIT.—Above, among the Rotol hydraulic equipment supplied for the Victor is this nose-flap unit.

UNDERCARRIAGE.—Above, the nose-wheel unit of the Victor's Electro-Hydraulics' undercarriage is shown here.

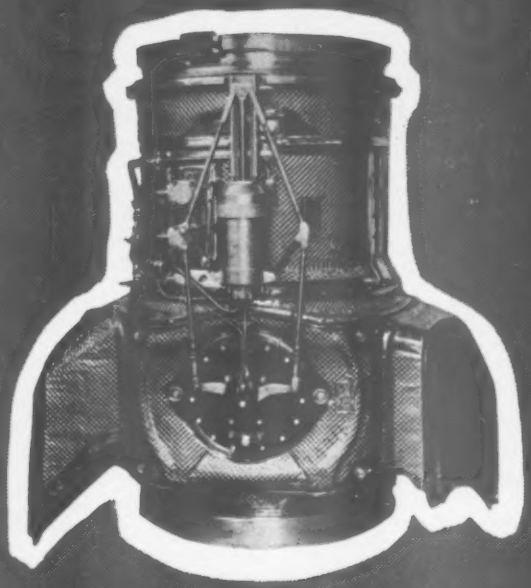


MASSIVE FORGING.—Above, this spar web-plate is hand forged by High Duty Alloys; its weight as forged is 450 lb. This is reduced to 200 lb. after machining.



ALTERNATOR.—Rotax 73 KVA alternators are used on the Victor B.1.

HOT-AIR VALVE.—One of the many items provided by Teddington Aircraft Controls, Ltd., is this hot-air valve.



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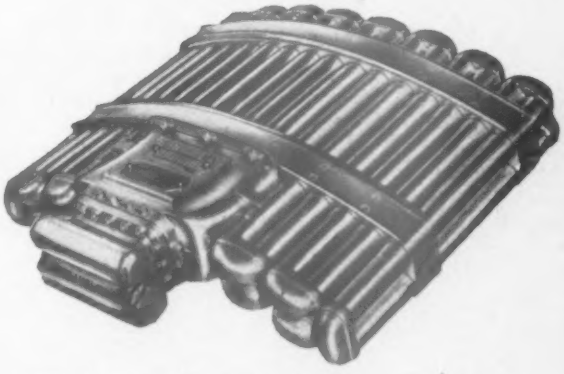
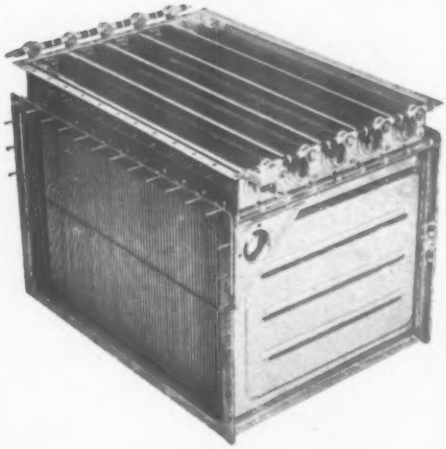
High pressure fuel-cooled oil coolers for high performance gas turbine engines. This unit is used in the Armstrong Siddeley Sapphire S.A.7.





Heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Argosy, the Vickers Viscount and the Handley Page Herald.

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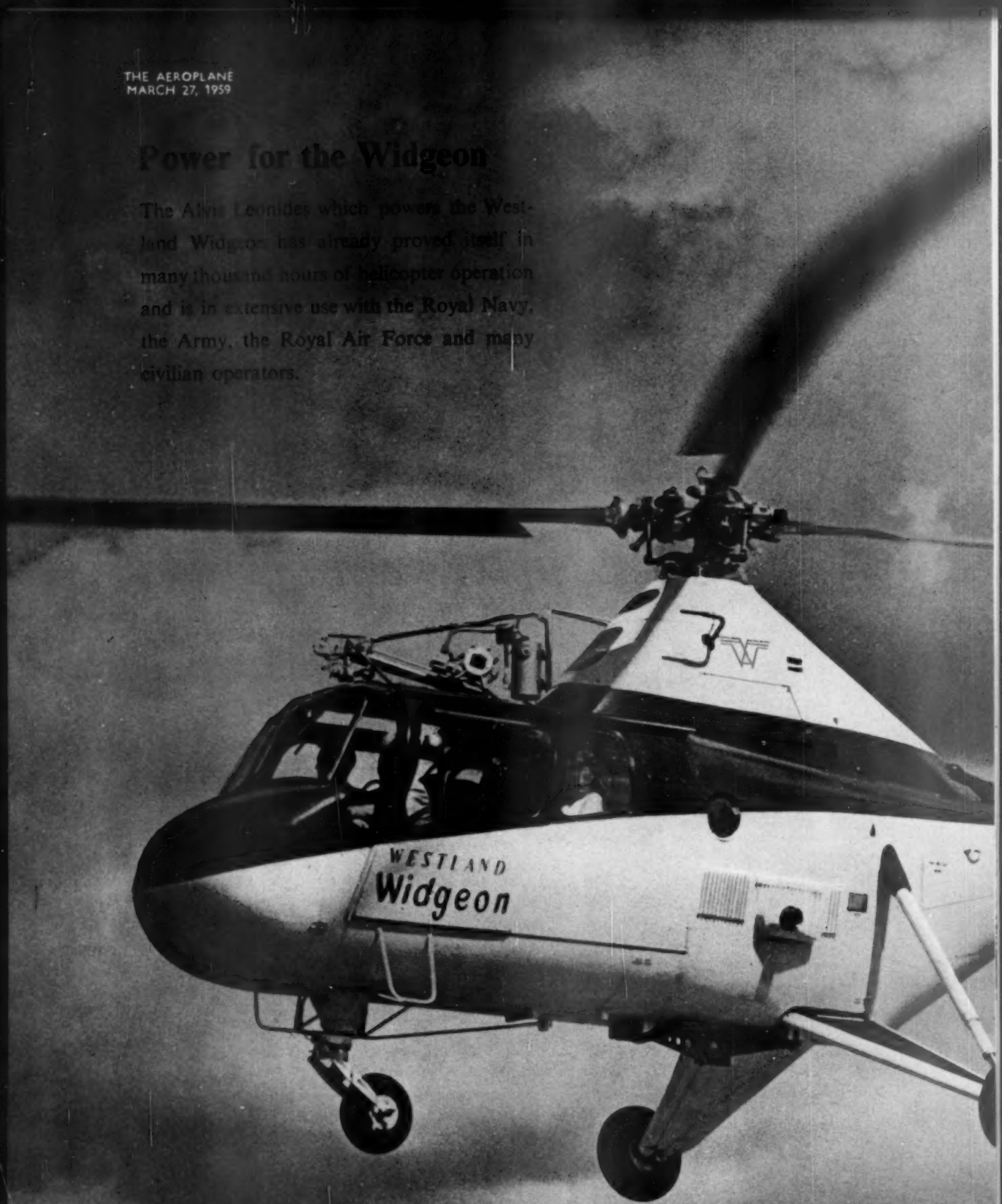

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The Fighting Services

Technical Training Appointment

AIR COMMODORE G. N. E. TINDAL-CARILL-WORSLEY, C.B., C.B.E., Senior Technical Staff Officer, F.E.A.F., since June, 1956, has been appointed Director of Technical Training at the Air Ministry with effect from May. He succeeds Air Cdre. J. R. Mutch, C.B., who is retiring from the Service. An armament specialist, Air Cdre. Tindal-Carill-Worsley previously commanded No. 1 School of Technical Training, R.A.F. Halton, and before that was S.T.S.O. at Flying Training Command.

Change of Rôle

HAVING operated Hunter F.6s from Cyprus for the past year, No. 208 Squadron is to assume a new rôle on April 1, although its 40-year association with the Middle East will not be broken. On that date its number will be taken over by a recently formed Venom FB.4 squadron at R.A.F. Khormaksar, Aden, which has temporarily held the number 142.

There will be a disbandment ceremony at R.A.F. Nicosia, when the Squadron's Hunters will fly past the C.-in-C., M.E.A.F., Air Marshal Sir William MacDonald. Afterwards No. 208 Squadron Standard will be flown to Aden in the care of the C.O., Sqn. Ldr. J. H. Granville-White, and an escort party, and handed over to No. 142 Squadron (Sqn. Ldr. R. Ramirez), which will from that moment become No. 208. This squadron move follows the recent announcement by the Secretary of State for Air that Hunters will shortly re-equip the Venom squadrons in the Arabian Peninsula Command.

No. 208 Squadron was formed in 1916 as No. 8 Squadron, R.N.A.S. It became No. 208 on the formation of the R.A.F. in 1918, but to old members is still known as "Naval Eight." In Aden it will operate side by side with No. 8 Squadron—the first time that "Naval Eight" and No. 8, which originated in the R.F.C., have shared the same base. Formed at a time when fighter units were urgently needed on the Western Front, No. 8 Squadron, R.N.A.S., was placed at the disposal of the R.F.C.

After the 1914-18 War it went to Egypt and has remained in the Middle East area ever since. During the 1939-45 War it was engaged on reconnaissance patrols in the early desert campaigns, and in 1941 went to Greece. Later that year the Squadron operated against Rashid Ali's forces in Iraq, then returned to the Western Desert. In the last year of the War it fought in Italy. Hostilities over, No. 208 returned to Egypt, and in 1956 was the last R.A.F. fighter squadron to leave the Suez Canal Zone.

Its year with Hunters in Cyprus has been eventful. Last summer six aircraft were detached to Amman during the period when, at the request of King Hussein, British forces went to Jordan to assist the Jordanian Government. On the eve of departure unit badges were exchanged at a formal dinner in Amman attended by King Hussein.

R.A.F. Colerne to be Honoured

IN recognition of the close associations which have existed between the City of Bath and nearby R.A.F. Colerne, the Freedom of Entry into the City will be conferred upon the station on April 4 by the City Council. The Mayor will present a scroll to the Station Commander, Gp. Capt. E. G. Watkins, C.B.E., A.F.C., at a ceremony at which 600 members of the station will parade. They will be commanded by Wg. Cdr. E. W. Merriman, O.B.E., D.F.M., Wg. Cdr. Flying at Colerne.

The Mayor will take the salute at a march-past in which the Queen's Colour for the R.A.F. in the United Kingdom will be paraded by an Escort Squadron of 90 airmen of the Ceremonial Drill Unit, R.A.F., Uxbridge, commanded by Sqn. Ldr. K. Courtnage. Nine Hastings aircraft of Transport Command from Colerne will fly past. The Freedom ceremony will be preceded by a civic luncheon in the Guildhall, at which the guests will include the Parliamentary Under-Secretary of State for Air, Mr. Airey Neave, M.P., representing the Air Council, Air Chief Marshal Sir Walter Dawson, Air Member for Supply and Organization, and Air Marshals Sir Andrew McKee and Sir Douglas Jackman, A.O.C.-in-Cs, Transport and Maintenance Commands respectively.

During the 1939-45 War Colerne was a fighter station and the early re-equipping of squadrons with jet aircraft took place at the station. It became a Transport Command unit in January, 1957, its first aircraft being Hastings of No. 24 (Commonwealth) Squadron, soon followed by those of No. 511 (now No. 36) Squadron. Colerne is also the home of No. 49 M.U., which since 1946 has undertaken special modification and re-equipment work on both Bomber and Transport Command aircraft.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Transport Command: Wg. Cdr. H. S. Maurice-Jones to Headquarters for administrative staff duties.

Flying Training Command: Wg. Cdr. V. E. M. Harding to Headquarters for administrative staff duties; Wg. Cdr. A. J. D. Maclachlan, D.F.C., to the R.A.F. College, Cranwell, as Deputy President of the R.A.F. Selection Board.

Technical Training Command: Gp. Capt. A. W. Caswell, O.B.E., to No. 2 School of Technical Training, Cosford, to command; Wg. Cdr. G. J. Spence to Headquarters for administrative staff duties; Wg. Cdr. G. A. H. Wright to the Radio Engineering Unit, R.A.F. Henlow, as Senior Technical Officer.

Miscellaneous: Wg. Cdr. P. G. K. Williamson, D.F.C., to Headquarters, Allied Forces Southern Europe, for organization and training duties.

Reunions

No. 1 S.F.T.S. (I) Ambala.—The 12th reunion will be held at the Chevrons Club, London, on April 4. Details from Mr. S. Booth, 28 Dene Road, New Southgate, N.11.

Bristol U.A.S.—The sixth annual dinner is being held in the Hawthorns Hotel, Bristol, on May 15. All members and ex-members are invited to attend and should contact the mess secretary, Officers' Mess, Bristol U.A.S., 12 Whiteladies Road, Bristol, 8.

Coastal Command.—The annual reunion of Coastal Command officers will be held in the Officers' Mess, R.A.F. Northwood, on May 2, at 18.00 hrs. Particulars and tickets (price 15s. each) may be obtained from the hon. sec., Wg. Off. M. F. Arkell, Headquarters, Coastal Command.

OVER THE ULU.—Auster AOP.9s of No. 656 Light Aircraft Squadron, Army Air Corps, operate over the Malayan jungle on a range of anti-terrorist, communications and supply-dropping duties. Commanded by Lt. Col. B. B. Storey, M.C., and based at Kuala Lumpur, the Squadron also has Flights at Taiping, Ipoh, Seremban and Sembawang, on Singapore Island.

Flying the Dart Herald

by John Fricker

AFTER an extensive development programme dating from the first flight of the Leonides Major-powered prototype on August 25, 1955, the Handley Page Dart Herald is shortly to leave on a sales and demonstration tour along the route to India, where interest has been shown in its possible production under licence.

With the conversion of the design from four piston engines to two Rolls-Royce Dart R.Da.7 turboprops has come a widening of the possible market for a pressurized medium-weight transport, which is capable of operating from relatively small and unprepared airstrips with a load of up to 43 passengers over moderate sector distances.

The change to turboprop power has been gracefully accomplished and only in the offset fore-and-aft sections of the engine nacelles is revealed the piston-engined parentage of the shapely Herald. This arrangement was necessary to obtain a suitable run for the jet pipes of the Darts, while retaining the original aft inner nacelle and main undercarriage units. The resultant "step" on the inboard profile of the nacelles provided a convenient location for intakes to the heat exchangers for the thermal de-icing system, to the alternators and generators, and for the cabin-air intercooler.

In its revised form the Herald has at the moment few competitors, particularly where short-field operation is concerned. This aspect of its performance, gained from low wing and power loadings, coupled with Fowler-type flaps amounting to some 18½% of the total wing area, provided perhaps the most outstanding personal impression of the Herald during a recent brief handling flight at Radlett. Equally commendable, however, were the low-speed handling and general docility of control, which were likened by one of the senior pilots sampling the Herald on the same occasion to that doyen of the gentlemanly fraternity—the Anson.

For the recent handling flights, the second prototype Herald, G-AODF, forsook the rough turf of its birthplace at Woodley for the Radlett runways in the hands of Handley Page test pilot "Spud" Murphy, who patiently supervised the maltreatment meted out to his charge. The aircraft had not then been fully furnished for its overseas tour; soundproofing was not complete, and half the fuselage was occupied by the cameras and banks of instruments of automatic observers.

Normal capacity of the 2,152-cu. ft. cabin is 38 passengers seated in pairs on each side of the fuselage, with a freight compartment aft of the cockpit, and a single toilet opposite the rear door in the port side of the cabin. An additional door is provided in the front fuselage for the crew, who would normally comprise first pilot, second pilot/navigator/radio operator, and steward or stewardess. The pilots are accommodated on a raised and roomy flight deck, in seats adjustable for height and rake, and with folding arm rests.

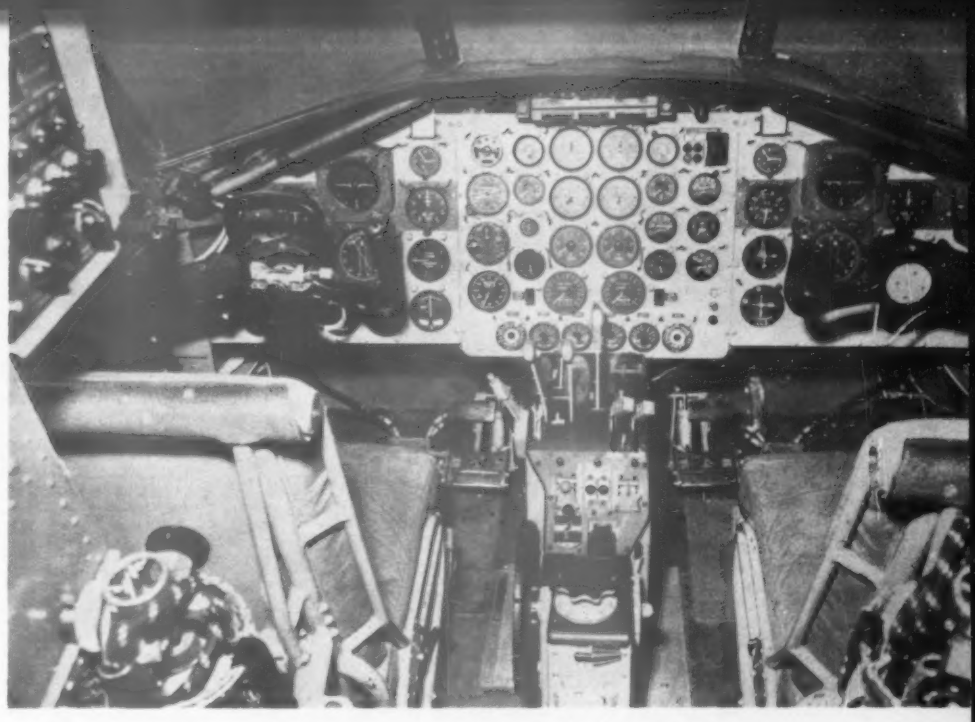
Full dual control, including duplicated toe brakes on the rudder pedals, is fitted, except for the provision of nosewheel steering for only the first pilot. Two panels of standard flight instruments confront the pilots, while the centre group of instruments apply almost entirely to the powerplants. The main engine indicators run in a double row from top to bottom of the centre panel, and comprise torquemeters, for power output assessment; twin-needle tachometers; turbine gas temperature (T.G.T.) gauges; and fuel flow meters incorporating "pounds gone" Veeder counters.

At the bottom of the centre panel are individual gauges for the three fuel tanks in each wing, which have a total capacity of 1,068 Imp. gal. These tanks function as two groups of three, and the pilot has a cross-feed cock to supply either engine with fuel from each wing, if required. The switch for this control is on a panel immediately above the windscreen, which also contains the engine starting, water/methanol injection controls, L.P. cock and feathering switches, and many other associated items. To the rear of this panel in the cockpit roof is another bank of controls for the comprehensive radio equipment installed in the Herald.

The flying controls are conventional, with ram's-horn type handwheels mounted on cranked columns, and rudder pedals quickly adjustable for reach via a foot-operated worm shaft. In these days of electric trim actuators with (often too) remote position indicators, it is refreshing to encounter again the classic type of manual trim wheels for elevators, rudder and ailerons. Positioned each in its logical plane, grouped to the rear of the central control console, accessible to either pilot, and providing a direct and positive indication of trim position, these S.B.A.C.-type handwheels are all that can be required for an aircraft without power-boosted controls. When geared as judiciously as in the Herald, to provide sensitive and accurate trimming with little or no backlash, and for a small degree of effort, they are unbeatable.

Forward of the trimmers are the principal engine controls, comprising single power levers combining throttle and pitch functions for each Dart; one lever regulating the ground and flight fine-pitch stops; and H.P.-cum-airscrew feathering cocks. On the left of the console is a lever for the flying control locks, and this is interlinked with the engine power levers to prevent them both being fully opened when the locks are

The second prototype Dart Herald, G-AODF, which was converted from Leonides Major power and was further modified by the addition of a dorsal fin.



Full dual control is installed in the Dart Herald, except for the nosewheel steering stirrup, which is shown in its raised position on the first pilot's control column. Most of the aircraft warning lights are grouped together in a strip at the top of the centre panel

Photograph copyright "The Aeroplane"

engaged. There is also a linkage between the power levers and the fine-pitch stop control, which replaces the microswitch system on the undercarriages of other Dart-powered aircraft such as the Viscount.

For starting and taxi-ing the fine-pitch lever must be to the rear, in the "ground" position, to withdraw the pitch stops so that the airscrew blades present the minimum drag to the engine, but as the power levers are opened for take-off, and the propellers coarsen to absorb the power, the pitch-stop lever automatically springs forward to the "flight" position.

The fine-pitch stops prevent the airscrew blades from reducing pitch below 17° in flight, thereby eliminating the risk of "discing," which would result in very high drag and loss of control through the drastic reduction of airflow over the tail surfaces. In the air, the blades fine-off in an attempt to maintain constant speed as power and airspeed are reduced, but on the ground, under similar conditions, they must be allowed to do so, to avoid compressor stall and engine overheating. When engaged, the flying control lock lever also prevents movement of the fine-pitch stop to the "flight" position, for which there are appropriate warning lights in a double strip of these indicators at the top of the centre panel.

This group includes oil pressure, thermal de-icing, turbine overheat, blade angle, engine fire and inverter power failure warning lights, comprising 18 indications in all. The risk of confusion is avoided by identifying names on each light.

Starting the Dart 527s, which deliver 1,910 s.h.p. plus a jet thrust of 505 lb. for take-off, or the equivalent of 2,100 h.p., is by the usual automatic sequencing, via a single starter button and a selector for each engine on the overhead panel. Within 30 sec. the engine has reached its self-sustaining speed of 3,500 r.p.m., and the starter button springs out again for immediate selection of the other powerplant. The power levers may then be opened up to the ground-idling setting of about 8,000 r.p.m., at which the airscrew blades are still in almost the fully fine position, as indicated by zero torque readings.

A careful eye must be kept on turbine gas-temperatures during starting, to ensure that the limits of just over 900° C. are not exceeded. The T.G.T.s, which are measured by thermocouples in the exhaust cone, are rather higher than the jet-pipe temperatures normally indicated for cockpit reference, being taken closer to the turbine assembly. To avoid exceeding the maximum T.G.T. limits when opening up to full power it is necessary with all Dart-powered aircraft to regulate the fuel supply before take-off, according to the ambient air temperature, to restore the correct fuel-air ratio.

This is done for each engine by an appropriate fuel-trimmer switch on the centre console, with rich and weak selections, and corresponding indicator dials among the engine instruments. Trimming values are set up after reference to a fuel datum computer, the QFE (airfield barometric pressure) and prevailing air temperature having been obtained from air traffic control. The same procedure is also adopted for landing after flights between airfields of differing ambient conditions

In high temperatures, of course, take-off power may be considerably reduced by the decreased fuel flow, caused by fuel trimming to match the lower mass air flow, and water/methanol injection into the first-stage compressor of each engine is therefore possible to restore this loss. Vaporization of the water restores the air mass flow, while combustion of the methanol compensates for the fuel which has been trimmed off.

There was no power-loss problem in the near-freezing conditions of our handling flight. With a fairly full load of fuel and a half-dozen or more passengers, we taxied out at Radlett some 3,000 lb. short of the maximum gross weight of 37,000 lb. This is also the maximum landing weight, so that no fuel jettison facilities are needed. Taxi-ing is done with the flying controls locked, opening up to about 11,000 r.p.m. to start the aircraft moving, with gentle movement of the throttles to avoid excessive T.G.T.s. Ground manœuvrability is very good, through the medium of a steerable nosewheel, which is controlled by a stirrup hinging upwards from the first pilot's control column.

Very tight turns are possible with the plus or minus 55° travel of the nosewheel steering, although the control wheel on the second prototype Herald was in need of adjustment to eliminate a slight amount of backlash. The toe-actuated Goodyear disc brakes are light and effective, and will hold the Herald at full power before take-off. The full-power check of 15,000 r.p.m. for 5 sec. is the last of the vital actions, which includes neutral control trims, fine-pitch stop withdrawal lever to "flight," blade angle indicator lights out, and flight fine-pitch warning lights out.

Flap is normally used for the shortest ground run, and is selected by a hydraulic control lever in a central quadrant. Three settings are provided: up, take-off and down, with three pairs of indicator lights on the top right-hand side of the central instrument panel. When a flap position is selected, the upper pair of white lights come on to show that they are in transit, and remain on for some time, as an apparent indication of their very slow travel. The central pair of lights show green for the take-off setting, while the lower pair give the same indication for full flap.

Releasing the brakes at the take-off power of about 320 p.s.i. torque results in a really fierce acceleration, and only a brief period of nosewheel steering is necessary to keep straight before the large rudder becomes effective at something like 40 knots. Moderate back pressure on the control wheel at about 80 knots is then required to raise the nose and, at Radlett, the Herald then unstuck smoothly at 85-90 knots. The minimum control speed V_{mca} is 80 knots I.A.S., while the safety speed of 90 knots, at which it is possible to climb away after engine failure, is reached almost immediately on becoming airborne. In a light wind almost directly down the runway the take-off run appeared to be little more than about 500 yd.

The initial climb-away was fairly shallow, while undercarriage and flap were raised, both with little change of trim, but as the Herald began accelerating to its en-route climbing speed of 150 knots, it was already indicating an ascent of 1,500 ft./min. At the maximum continuous power setting of 14,400 r.p.m. (1,920 e.h.p.), we climbed through a thin layer of stratus to 10,000 ft., where "Spud" Murphy demonstrated the tractability of the Herald, with a series of stalls in varying configurations.

Starting with the aircraft clean, throttled back to flight idling and trimmed to 1.3 V_s (112 knots), the penetrating airscrew whine in the cabin quietened to a soft whistle as the nose was slowly raised. It was fascinating to watch the engine tachometers steadily unwinding as the revs. fell progressively with the airspeed, until a slow and majestic stall breakaway

came at about 80-85 knots after little aerodynamic buffet. To achieve this stall required almost full aft travel of the control column, with an effort, in its later stages, increasing from about 30 to 70 lb.

The first stall was absolutely straight, as was the next one, with flaps and undercarriage down, and a little power, trimmed to 105 knots in the approach configuration. Once again the breakaway was fairly abrupt, at about 70-75 knots I.A.S., but with the nose dropping slowly through and the wings remaining level. A second stall in the "all-down" configuration resulted in a port wing drop, but it is apparently possible to retain lateral control down to the stall by coarse use of the aileron.

Trimmed to 95 knots, with flaps and undercarriage down, and engine revs. having fallen to 8,000 r.p.m., the Herald finally exhibited slight buffet at about 75 knots I.A.S., and the breakaway followed some 10 knots lower, at a speed creditable enough for many light aeroplanes.

The small degree of stall warning is representative of most aerodynamically clean aircraft and, as usual in these cases, it is being met in the Herald by the installation of a stick shaker to provide artificial buffet indication to the pilot.

In low-speed handling I found the Herald commendably responsive, and throughout the speed range the controls remain well harmonized and relatively light, with the aid of spring tabs, for the size of the aircraft. It is possible to make Rate 4 turns accurately and without loss of height at 90 knots, and at the other end of the airspeed scale the effort required to roll the Herald from bank to bank is refreshingly moderate, although the inertia of its 94-ft. span can be felt.

At the low altitudes in which most of our time was spent, the Herald's "never-exceed" speed of 214 knots was not far off the 200 knots I.A.S. resulting from a typical cruise setting of 13,500 r.p.m. (230 p.s.i. torque), but at the normal operating heights of 15-17,000 ft., where the T.A.S. becomes about 275 m.p.h., the I.A.S. falls well below V_{ne}. In any case, the design diving speed of the Dart Herald is 267 knots E.A.S.

Lateral control effectiveness of the Herald may be judged from the B.C.A.R. requirement for a rate of roll, in the approach configuration, from a 30° bank in one direction to a similar attitude in the other, within 7 sec. This, of course, is primarily an outside criterion for very large transport aircraft, but the Herald is able to meet the 60° roll requirement in 4½ sec. A similar requirement for a 60° change of bank on the initial climb with the critical engine feathered within 11 sec. is met by the Dart Herald with a time of 7 sec.

The Rolls-Royce Dart has auto-feathering capabilities in the event of a power loss, but the H.P. fuel cocks on the central console may also be used for manually feathering an engine. As I found when Murphy cut the port engine for me, the yaw on asymmetric power can be held with a surprisingly small foot load, especially as the feathering sequence is so rapid, and the additional dorsal fin of the Dart Herald undoubtedly contributes to this quality. It is not until the power of the remaining engine is increased to maintain the best single-engine speed of about 150 knots that the need for rudder trim is really felt. About four divisions suffice to bring the ball of the slip indicator back to the centre, and the Herald then goes on flying as happily as on two engines, with turns in either direction being completely uneventful at steep angles of bank.

Changes of trim at all times remain quite low, those with differing power being no exceptions. Power lever movement can be as rapid as desired in the air, turboprop response being generally quicker than is possible with piston engines, but a characteristic of Dart power changes seems to be to overshoot by several hundred r.p.m. when the levers are pushed forward, before falling back to the intended setting.

Before rejoining the circuit at Radlett, which eventually reappeared in the murk, I tried a simulated overshoot from the approach configuration. This is sometimes interesting with an aeroplane having such large flaps as the Herald, but from a trimmed condition at 105 knots, with flaps and undercarriage down, and only a trickle of power, opening up to full bore resulted in a nose-up trim change which could be held quite comfortably with one hand, while the other was free to retrim, select undercarriage up and so on.

Reducing power for undercarriage extension, below 145 knots, required slight aft trim, and with half flap, the speed gradually fell off to about 120 knots downwind. From the right-hand seat the view in a left-hand circuit was difficult to assess, but the general visibility from the cockpit of the Herald seems typical of most pressurized transports. At about 11,000 r.p.m. and 140 p.s.i. indicated on the torquemeters, the rate of descent was about 600-800 ft./min., which increased with the selection of full flap on finals, accompanied by a useful slight nose-up trim change.

Airspeed was then allowed to decrease from about 105 to 90 knots, power being taken off at the threshold. The final approach angle of the Herald seems almost level, and only a little aft movement of the control column is needed to counteract the slight nose-down tendency accompanying the removal of engine power. At our landing weight of about 31,000 lb., a firm touch-down was made on the rather hard 10 ft./sec. mainwheels at 75 to 80 knots, the Herald pitching forward almost immediately on to its nosewheels. Nosewheel steering can then be brought into action, and a substantial braking effect obtained by pulling back the lever to withdraw the flight fine-pitch stops. With this technique, and the judicious use of brake, the normal landing run is little more than 400 yd.

With a mean fuel consumption of about 190 gal./hr., and a cruising performance as good as anything in its class, to satisfy its potential operators, the Dart Herald has an additional appeal in its low speed and short field characteristics, and will undoubtedly endear itself to its pilots.

Leading Particulars

DIMENSIONS.—Span, 94 ft. 9¼ in.; length, 71 ft. 11 in.; height, 23 ft. 4 in.; mainwheel track, 22 ft.; gross wing area, 890 sq. ft.

WEIGHTS.—Empty, 21,422 lb.; basic operating weight, 22,269 lb.; max. payload, 10,160 lb.; fuel and water/methanol, 4,032 lb.; max. gross weight, 37,000 lb.

PERFORMANCE (at max. weight).—Cruising speed, at 15,000 ft. and 13,800 r.p.m., 239 knots; nautical air miles per pound of fuel, 0.14; climb, from 5,000 ft. at I.S.A., 1,750 ft./min.; at 15,000 ft., 1,100 ft./min.; service ceiling, 29,500 ft.; take-off distance to 50 ft., 2,200 ft.; with one engine failed at safety speed, 4,170 ft.; landing distance from 50 ft., 2,190 ft.; range with full tanks and 6,000 lb. payload, 1,230 nautical miles; range with max. payload of 10,160 lb., 600 nautical miles.

The final approach angle at about 85-90 knots of the Dart Herald is fairly flat, and the change of attitude for the flare-out relatively small. The slot between the mainplanes and the Fowler-type flaps on their full extension can be seen in this photograph.

Fisons Display Farm Flying

A Tiger Moth demonstrating its crop-spraying capability at Downham Market; a particular attraction of this aircraft is that it is relatively cheap to buy and operate.

SEVERAL hundred farmers and representatives of the National Agricultural Advisory Service (N.A.A.S.) and British Sugar Corporation gathered at Bexwell aerodrome, near Downham Market in Norfolk, on Thursday, March 19, at the invitation of Fisons Pest Control, Ltd., to watch a demonstration of current types of agricultural aircraft. Many had already experienced the value of aerial crop-spraying, because Fison-Airwork, who have managed the company's flying activities since 1955, averted a major disaster last year by spraying 56,000 acres of potatoes which were threatened by blight.

Above, helicopters, such as the Hiller 360, are well suited for agricultural spray work—the rotor downwash assists penetration into foliage and landings can be made in or near the operating area.

The main purpose of the demonstration was, therefore, to introduce three newly developed chemicals and to prove to the more sceptical guests that there is little danger of spray and dust drifting onto crops other than those for which they are intended, provided the aircraft are properly equipped for the job and are flown by experienced pilots.

Despite winds that gusted up to 15 knots, the pilots achieved their object by bringing the succession of fixed-wing aircraft and helicopters past the enclosure low, slowly and with extreme accuracy. As they did so, assorted sprays, dusts, fertilizers and slug pellets streamed down on to a tiny area of what must now be the most thoroughly chemicalized grass in the World.

Altogether, there were eleven separate items on the programme, performed by two Hiller 360s with spray-booms, three Tiger Moths with either spray-booms or under-fuselage venturi, an EP.9 Prospector with venturi, a Chipmunk 23 with spray-booms and a Piper Super Cub with venturi. Not all of these aircraft are owned by Fison-Airwork, because the crop-spraying period in the U.K. is so short that it is more economical to bring in other operators under sub-contract at peak periods than to try to find year-round employment for a vast fleet that is needed only for 10 weeks in June, July and August.

Thus the Super Cub was flown by Brian Collins of Farm-air, the Chipmunk by Roy Matthews of Agricultural Aviation, and the EP.9 by Ladislav Marmol, whose exploits showed how much we have missed by not being able to see this superbly manœuvrable and versatile aircraft at Farnborough. By banking vertically at turnip-top height, he demonstrated that the EP.9 can achieve a 15-second turn between spray-runs, which rivalled even the helicopters and was stated to have made possible an application of six tons of chemicals per hour by this one aeroplane during a recent operation in Yorkshire.

Fison-Airwork's contribution comprised the Tigers and Hillers, the latter featuring the new spring fashion of fluorescent red skids and tail-boom extremity. With 28 Hillers (plus five Whirlwinds for other jobs) Fison-Airwork claims to be the World's largest helicopter-spraying contractor. A booklet given to each guest mentioned only 27 Hillers, but we were told that this was understandable as "it went to press last week." Such is the rate of growth of an enterprise that began experimentally just 11 years ago with a single S-51 and now obtains up to 1,050 hours of profitable annual utilization for each of its small helicopters.—J.W.R.T.

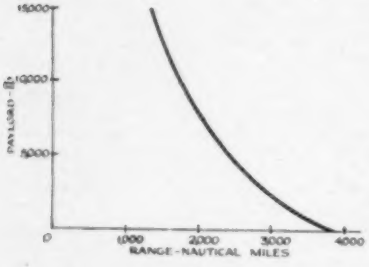
Right, above, this special version of the Chipmunk was developed specifically for crop spraying and similar duties. Right, the Piper Super Cub, used for fertilizer spreading.

Photographs copyright "The Aeroplane"

Blue Streak as a Space Vehicle

ONE of the main aspects of the development of the Blue Streak LRBM is its potential as a space vehicle. This was revealed by the Under Secretary of State for Air in the air-estimates debate on March 5 and, in the light of his statement, an interesting assessment can be made of Blue Streak's potentialities both as a missile and as a satellite launcher.

Recent lectures on missile and space technology give an excellent basis for such a study. Inevitably, much must be guesswork in any assessment of this sort, but the results show clearly that Blue Streak has considerable possibilities as a satellite vehicle.



LRBM PERFORMANCE.—In this "range-payload" graph for Blue Streak the payload estimated is the combined weight of a re-entry nose-cone plus warhead plus any decoy devices which may be carried to mislead defensive missiles.

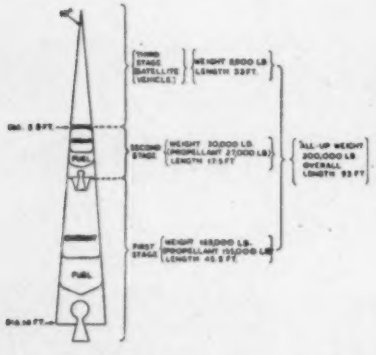
Calculations can be based on a widely published photograph showing Blue Streak in a test-rig at Hatfield. The size of the missile's oxidant tank can be estimated from this photograph. If liquid oxygen and kerosene are assumed as the propellants, a total propellant weight of 175,100 lb. can be derived. If specific impulse is taken to be 250 sec., the engine thrust comes out at 291,000 lb. for a running time of 150 sec. This seems excessive, but can be reduced only to 243,000 lb. if the optimistic running time of 180 sec. is assumed.

Weights can be estimated from the typical percentages given in W. H. Stephens' paper (Ref. d); these give structure weight as 4,380 lb., engine weight as 3,500 lb. and the weight of controls and unburnt propellant as 2,620 lb. Thus the all-up weight, less payload, comes out at 185,600 lb. On this basis the structural efficiency parameter is 0.943, which cross-checks well with a graph in Stephens' paper which relates this parameter to the mean propellant density.

By adding a range of payloads to 185,600 lb., mass ratios can be calculated for Blue Streak and the relevant ranges read from a graph in Stephens' paper. The results are shown as a "range-payload" graph.

These calculations indicate that for a range of 2,500 n. m.—reported to be its design range—Blue Streak may well carry a payload (i.e., warhead plus re-entry nose-cone) of around 5,000 lb. and have an all-up weight of around 190,000 lb. Advanced propulsion and structural techniques have obviously been needed to achieve such a performance with a single-stage vehicle; its mass ratio for a 2,500-n. m. range approaches 13.

It can be guessed that both the payload and all-up weight of Blue Streak would be lower if the missile were to be designed today. Calculations based on Stephens' paper suggest that a two-stage vehicle to carry a 5,000-lb. load over 2,500 n. m. would weigh about 100,000 lb. compared with 190,000 lb. for the single-stage Blue Streak.



SPACE VEHICLE.—Similar in all-up weight to Blue Streak, this satellite launching missile appeared in W. H. Stephens' recent R.Ae.S. paper.

TEST MISSILE.—Estimates of Blue Streak performance can be based on photographs which show the missile in a test-rig at Hatfield.

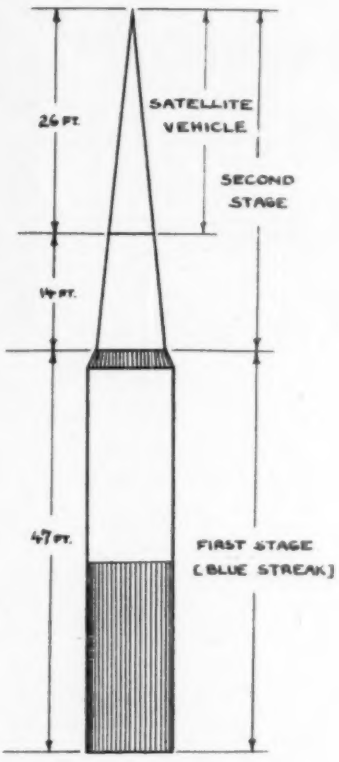
Payload weight as well as staging also greatly influences the launching weight of a missile. There has recently been an interchange of information on nuclear warheads. These warheads have doubtless become lighter and less bulky for the same explosive effect. Thus Mr. Duncan Sandys may well have been making a virtue of necessity when he spoke recently of Blue Streak's potential for stretch and its ability to carry anti-missile countermeasures. This may well be possible because Blue Streak will carry a lighter warhead than originally intended.

If a missile with Blue Streak's performance were to be specified today, it would probably be produced as a much lighter multi-stage missile with a lighter warhead. There is certainly a trend towards the lighter multi-stage missile; the best-known of these is the U.S. Minuteman ICBM. But although Blue Streak may be a big missile for its military rôle, its size will prove a great advantage if it is to be used for satellite launching.

In Stephens' paper a hypothetical satellite vehicle was shown; this vehicle, illustrated here, will repay close study, as it could have been based on Blue Streak. The weights of its first stage are similar to those which have been deduced for this LRBM.

If this vehicle is based on Blue Streak, it may give a slightly optimistic impression of this missile's ability as a satellite launcher. But even if a series of somewhat pessimistic assumptions are made.

(*Continued on page 385*)



SATELLITE LAUNCHER.—Based on Blue Streak, this two-stage vehicle has a launching weight of 194,500 lb. The satellite itself weighs 2,170 lb., but this would be increased to 4,300 lb. if it did not separate from the second-stage structure. Propellant and total weights for the first stage are 159,100 lb. and 170,800 lb. respectively, and for the second stage 19,400 lb. and 23,700 lb.

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Commander V. Cus	Italian Air Force
J. Bryce	Vickers-Armstrongs (Aircraft) Ltd.
A. E. Gunn	Boulton Paul Aircraft Ltd.
P. M. R. Walton	Sir W. G. Armstrong Whitworth Aircraft Ltd.
J. Zurakowski	Avro Aircraft Ltd. (Canada)
M. C. Muir	De Havilland Aircraft Co. Ltd.
G. J. Horne	Vickers-Armstrongs (Aircraft) Ltd.
J. Haflinger	F.F.A.G. Switzerland
R. Bignamini	Fiat Aircraft Company
J. Brunner	S.T.M. Switzerland
D. Knight	English Electric Co., Ltd.

Ensure that Martin-Baker Ejection Seats are fitted in your Prototype Aircraft

MARTIN-BAKER
Aircraft Company Limited

England & Canada

(*Continued from page 384*)

it is evident that a two-stage vehicle based on Blue Streak should be able to launch a satellite weighing at least a ton into orbit. Details of such a vehicle are given on page 384; an S.I. of 250 sec. and a mass ratio of 5.5 are assumed for each stage.

The satellite-launching ability of Blue Streak lines up with estimates made for U.S. missiles. A NASA official has said that the U.S. IRBMs have a potential orbital payload of more than a ton, while the ICBMs should be able to put 4-5 tons into orbit. The main modifications needed are structural strengthening and the development of suitable upper-stage rocket vehicles. These are now being produced in the U.S.

It is to be hoped that a suitable upper-stage vehicle will be produced to give Blue Streak a satellite-launching ability. Black Knight has been mentioned as a possibility, but could probably launch only a small satellite. An upper stage tailored to the needs of Blue Streak appears to be essential.—J.R.C.

References: The performance and weight estimates in this article are based on information from the following lectures:—

(a) "Some Propulsion Problems of High Altitude Rockets," by A. D. Baxter (Cranfield Symposium lecture, July 18, 1957).

(b) "Design Problems of Large Rockets," by K. J. Bossart (Cranfield Symposium lecture, July 18, 1957).

(c) "Performance Problems in Large Rocket Engines," by S. L. Bragg (R.Ae.S. Derby Branch lecture, February 2, 1959).

(d) "Earth Satellites," by W. H. Stephens (R.Ae.S. lecture, February 12, 1959).

Goodyear at L.A.P.

NEW, self-contained and well-equipped premises for the Goodyear Aviation Division were officially opened last Monday at London Airport. In the two-storey building are concentrated the office and service facilities which were previously operated from various points on the airport.

More important, perhaps, is the fact that the building carries equipment for the kind of servicing work which had previously to be sent to the Wallasey, Cheshire, factory. These facilities are such that the complete overhaul of aircraft wheels and brakes and associated systems can be done on the spot.

The premises are in the No. 1 Maintenance Area and are reached from the Great South West Road entrance to L.A.P.

Rain, Hail and Ice Crystals

THE importance of obtaining adequate information about the sizes and distribution of hail and raindrops was stressed, in an R.Ae.S. lecture on March 10, by Mr. R. F. Jones of the Air Ministry Meteorological Office. This information had become more essential with the increase in aircraft speeds—which were now such that raindrops as well as hail could inflict serious damage.

There were obvious difficulties in obtaining adequate statistics to make assessments of possible danger, but such estimates could now be based on radar and Doppler radar measurements.

The lecture was concerned with cloud physics problems associated with the measurement and estimation of the water and ice-crystal contents of the atmosphere and the size-distribution of the particles. Approximate answers are possible from theoretical work, but direct measurements are necessary if the quantities are to be usefully evaluated. Mr. Jones discussed the formation and distribution of supercooled droplets—possible in very small sizes at temperatures down to -40°C.—and of ice-crystal concentrations which had been found to be of much more than academic importance during the Britannia's icing trials. Mr. Jones, incidentally, was a member of the committee which inquired into the Britannia icing problems.

The Electrical Engineers Show

AMONG the exhibits of the 430-odd companies that took part in this year's Electrical Engineers (A.S.E.E.) Exhibition at Earls Court between March 17-21, were a number of items of aeronautical interest. These included aerodrome lighting equipment, a range of general aircraft electrical components and a number of developments in the guided missile field.

Under this latter heading were a selection of multi-pin sockets and plugs for ground-to-air guided missile requirements by William McGeoch and Co., Ltd., and a number of equipment wires for use in AAMs and SAMs. W. T. Henley's Telegraph Works Co., Ltd., displayed such wires with insulation of PVC, polythene or silicone rubber as used in Fireflash and Thunderbird missiles; and British Insulated Callender's Cables, Ltd., exhibited mouldings for missile connectors.

B.I.C.C. also had on show its new range of Uni-efglas and Tersil aircraft wiring cables which are superseding the company's earlier Pren and Nyvin cables in general aircraft use. Constructed of glass fibre and PTFE Uni-efglas cables have a working temperature range of from −75°C to +240°C, and Tersil cables are suitable for operation up to +190° C.

The General Electric Co., Ltd., exhibited an airport apron floodlight of the type designed for use at London Airport and a special neon obstruction light for installation on high buildings such as power station chimneys. The body of the L.A.P. floodlight is formed by the reflector which allows a high-power (1,000-watt) lamp to be used in a comparatively small unit.

To provide a good light distribution a heat-resisting spreader glass and a horizontal louvre system are employed. In the obstruction light a helical-formed neon tubing provides the required distribution of red light without loss due to filters.

In addition to its range of industrial transformers, Parmeko, Ltd., displayed a fully tropicalized and variable mains supply compensated version of its well-known airfield lighting circuit regulator. This equipment is used at many airfields for controlling the brilliancy of the runway approach lights and incorporates earth fault and remote indication facilities.

Albright (Engineers), Ltd., showed its slip ring assembly for the Fairey Rotodyne and Aircraft-Marine Products (Gt. Britain), Ltd., exhibited a range of aircraft connectors, terminal pins, ferrules and solderless wiring devices. The Plessey Co., Ltd., had on show its range of UK-AN plugs and sockets and other high-temperature connectors, together with aircraft relays.

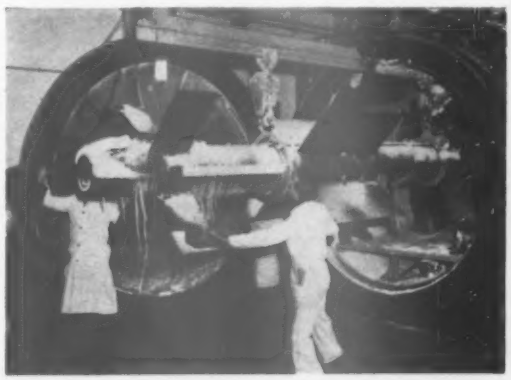
Various types of aircraft environment-proof and high temperature switches were displayed on the stand of Honeywell Controls, Ltd. An Austinlite cyclic switch as fitted to the tail unit of the Vickers Vanguard to operate the Napier Spraymat de-icing system was exhibited by Stone-Chance, Ltd.

A Graviner Appointment

FROM the Graviner Manufacturing Company comes the news that Mr. N. G. Bennett, M.B.E., A.F.R.Ae.S., M.I.A.S., has been appointed joint managing director of the company with Mr. A. Mathisen, O.B.E., B.Sc.(Eng.), F.C.I.R.A., A.F.R.Ae.S., who has been chairman and managing director since the company was founded 25 years ago.

For many years Mr. Bennett has had a close association with the problems of aircraft accidents and the technology of fire protection equipment.

Born in 1916 he was educated at Glasgow High School and the de Havilland Aeronautical Technical School. From 1937 to 1939 he was with the Air Ministry's Accidents Investigation Branch. During the War he was inspector in charge of the powerplant section, specializing in flight and crash fire investigation; he held the honorary rank of wing commander. Joining the Graviner company in 1946 Mr. Bennett became chief engineer of the aircraft division and a member of the board.



HARSH TREATMENT.—Environmental testing is an important feature of guided weapons development. Here an Armstrong Whitworth Seaslug naval surface-to-air missile comes out of the cold chamber where temperatures 20° below freezing are simulated.

Private Flying

H.J.C.'s CLUB COMMENTARY

● FROM May 8 to 10 the **Channel Islands Aero Club** is once more to hold an international air rally at Jersey. This will be the fifth of its kind, and an invitation is extended to all flying clubs to attend.

The rally will begin on the afternoon of Friday, May 8, when visitors will be received, and a banquet and ball will be held that evening. On the next day a public holiday has been proclaimed to celebrate the Island's liberation from German occupation.

Prizes will be awarded for arrival and lucky-landing competitions, and there will also be a *concours d'élégance*; a trophy will be presented to the outright winner of the rally.

The all-in fee for the rally is £6 6s. per person, which will cover all accommodation, meals, transport and other entertainment until breakfast time on the Sunday. Applications should be sent c/o Mr. L. W. Ross-Gower, 27 Hill Street, Jersey, by April 30.

Arrangements are to be made for an R.A.F. escort for those pilots flying from the South Coast; details will be made available later.

● WITH the withdrawal of the Goodhew Aviation Co., Ltd., from the operation of the **Oxford Aeroplane Club** at Kidlington at the end of last month, a new company is being formed to assume control. The board is to consist of P. S. Clifford, K. Elliot, P. Jewson, S. Jewson, P. Raison and R. Smith.

It has been necessary to raise annual subscriptions (to £4 4s. for flying members and £2 2s. for associate members), but these may now be paid half-yearly if desired. Flying rates on the Tiger Moth have been increased by 2s. 6d. an hour to £4.

Mr. C. F. Cockburn has retired from the club, and Rex Smith is taking over the duties of manager and C.F.I. Peter Clifford has accepted an invitation to continue as chairman for this year.

● FLYING HOURS at the **Exeter Aero Club** in February totalled more than 250 hr., a great improvement on the 90-hr. total of February, 1958. Recently C. J. Lane has flown solo and R. Outridge and P. Hodgkinson have made their first night solos.

The club committee now consists of F. Briggs, H. Butler, I. Cummings, I. Fisher, H. W. F. Hoskyns, D. H. King, Dr. A. R. Mills and J. Read. Denis King has been elected chairman of the flying sub-committee.

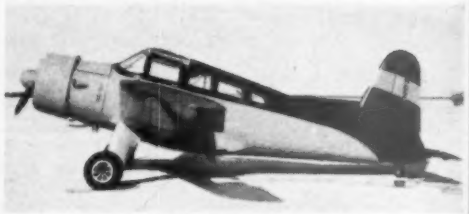
A breakfast patrol by the **Plymouth Aero Club** to Exeter is scheduled for April 26.

● BESIDES the circular tour proposed by the **Fair Oaks Aero Club** over Easter, mentioned in last week's issue, the **Lancashire Aero Club** is also planning something on these lines. At the time of writing no details of the route had been completed, but three Austers and two Tigers were to take part.

In February this club flew a total of 47 hr. 35 min., bringing the nine-month total to 1,002 hr.

● AN "At Home" party is to be held by the **Northamptonshire Aero Club** at Sywell aerodrome on Sunday, July 12.

On Easter Sunday and Monday the **Tiger Club** is to give a display at Sywell.



Levy-Sommerich photograph

VULTEE REVIVAL.—This Vultee BT-13, named the Viceroy, has been renovated by R. C. Kissick and M. Rutledge, at Waco Municipal Airport, Texas, and turned into a five-seat cabin aircraft. It cruises at 149 m.p.h. and with a constant-speed propeller has a climb superior to that of the standard aircraft. It is to sell at about $10,000.

● THE F.A.I. has just announced that a European Air Tour is to be held from June 17 to 21. It will be organized by the Royal Dutch Aero Club. Rotterdam, an aerodrome in Belgium, Vittel in France, Coblenz and Luxembourg will be included in the itinerary.

● WE HEAR from the **British Women Pilots' Association** that flying meetings this year are planned for May 9-10 and September 12-13. The venue of these occasions is to be announced later.

Gliding Notes

by Dr. A. E. Slater

WHAT is a qualified pilot? This is the question to which Air Cdre. Christopher Paul, the accidents analysis officer of the B.G.A., asked for an answer from his audience at the annual Instructors' Conference at the Kronfeld Club on March 14. "Qualified for What?" he was asked. "Qualified to fly without direct supervision of instructors," he replied.

The tendency has been to relax supervision after the first solo, but accident statistics have shown that the "over 5 hr. without Silver 'C'" is the most accident-prone group in terms of expense. After going solo, Air Cdre. Paul said, the pupil "really starts to learn from his own experience and knowledge, and should be very carefully supervised." He also needs "advanced dual instruction," but one snag is that not all instructors are qualified to give this advanced instruction.

When we have an Advanced Instructors' Panel visiting the clubs to pass out advanced instructors for being qualified to teach less-advanced instructors how to give advanced instruction, we shall have come a really long way from the pre-War Furness Gliding Club, whose entire membership started from scratch, without having had even elementary gliding instruction at any other club, let alone power flying experience. Yet they got the first "C" certificate, at their site overlooking the Duddon estuary, when the club was a year or two old, in April, 1933.

* * *

NEXT on the programme at the Instructors' Conference came Lorne Welch on "the teaching of field landings,"—a very necessary accomplishment because, as he said, if somebody is taking £1,000 across country he must be able to put it down still worth £1,000.

The proper choice of a field, Lorne said, is far more important than deciding when and how to land. In England there are enough suitable fields for the pilot not to worry when above 2,000 ft., at least outside large towns; but at 1,500 ft. one should have already picked a field, and below 1,000 ft. one should say to oneself out loud: "I am going to land," and do so.

But in choosing a field at least 150 yd. long, and 250 yd. for preference, one must not be deceived by the average size of the fields in the region where one happens to be; for instance, over Kent or Cornwall a 50-yd. field looks big, but over Lincolnshire a 200-yd. field looks small.

Lorne Welch is strongly against the habit of trying to get down into a field next-door to a telephone, or other facility, in preference to a better field farther off. As he pointed out, the time taken by the retrieving team in carrying the glider from the more-distant field is about equal to that needed for glueing a small patch on the fabric; whereas a write-off costs 1,000 man-hours, "in which you could walk from here to the Pyrenees and back, pushing a glider all the way."

He also warned instructors that some town-dwelling pupils, accustomed to viewing the country from the inside of a car, if at all, are quite unfamiliar with the country-side and may never have stood in the middle of a field in their lives. Finally, the tactful way to approach a farmer is not to tell him that you deliberately picked his field, but to put it across that you failed to reach your destination and were unintentionally forced to land.

* * *

KEN MACHIN, in introducing a talk on "fun and safety on expeditions," admitted that the Cambridge University Gliding Club had broken more gliders at experimental camps than any other club, but that was because it had held more experimental camps. A remarkable feature of such camps, the club has found, is that a competent instructor, as soon as he arrives on a strange site, becomes completely irresponsible.

If the camp begins with a few non-flying days, this "irresponsibility factor" will increase, so that the first launch off the hill (and it is usually a hill) results in a trickle over the edge, with subsequent damage, because the "experienced" instructor has over-estimated the wind by 100%. "Thou shalt not trickle" must be the rule. Another cause of trickling is failure to appreciate the weight of many modern sailplanes; for instance, you cannot launch an Eagle by bungey, even down a gentle slope, unless the wind is blowing at least 20 knots.

Another way of breaking machines, Machin said, is to try to land on top of the hill; this is "very, very rarely worth while." As to practising "dummy runs" first, they have to be done at a greater height than that needed for landing, so any downcurrents such as the "curl-over" behind the brow of the hill may be missed, and not allowed for in the subsequent landing.

The meeting ended with an invitation by Ann Welch to the audience to bring up anything they wanted to discuss, beginning with the question "What is a qualified pilot," which Air Cdre. Paul had asked them to answer at the start. Unfortunately, he had to leave early, so did not hear the general agreement to a proposition that the question could not be answered because a "qualified pilot" could not be defined. So we are left with the problem of how much supervision should be given to those "over 5 hr., but without Silver 'C'" pilots who are responsible for at least half the annual cost of glider repairs.

Correspondence

Has It A Future?

THE Royal Aero Club has been very interested to see the great interest taken in the cause of private aviation by THE AEROPLANE, and we would like to take this opportunity of thanking you for the invaluable support for the light aircraft movement, which has been afforded by your editorial columns, in what is becoming in this day and age very much a fight for survival for light aircraft.

London, W.1. J. H. BLAKE.
(Public Relations Officer, R.Ae.C.)

[We are grateful for this expression of gratitude; however, the degree of motion attained by any movement must depend on the enthusiasm of the members of that movement. We would like to see a more vigorous lead given in the private-flying field by the organizing of more rallies, such as the excellent one laid on for Easter by the Fair Oaks Aero Club.—ED.]

Altimeter Presentations

CONFUSION has always existed—and will always exist—where more than one needle is used for an altimeter.

Because of weight and space limitations, we have been too hidebound in trying to pack indication for heights of up to 50,000 ft. into a 2-in. case. Why should we not learn to use a respectable dial with a single needle which could only be read one way?

Blandford, Dorset. P. G. PROCTER.
(Sales Manager, Flight Refuelling, Ltd.)

A Cut-down Derby Winner

I FEAR that Mr. W. E. Clark (March 13) is mistaken regarding the type number of the 1919 Aerial Derby winner, which was correctly quoted in THE AEROPLANE of February 20. The machine was in fact the Airco D.H.4R, a crude conversion of a D.H.4 with a cut-down lower wing, diagonal struts supporting the upper wing and a Napier Lion mounted above a rectangular honeycomb radiator.

The D.H.9R came later and was very much cleaner aerodynamically. It was a single-bay biplane of unequal span with a properly cowled Napier Lion. The D.H.4R was flown from the front cockpit under the centre section. In the D.H.9R the cockpit was aft of the centre section, as in the 9 and 9A.

Cheltenham Spa, Glos. D. L. BROWN.

Blériot's Landing

I AM writing a short story, which I hope will be of sufficient interest to be included in a works journal, about the progress of aviation, and this includes mention of Louis Blériot's cross-Channel flight in the year 1909.

In this connection, I would very much like to obtain a photograph of M. Blériot's actual landing at Dover, as I feel sure it would give added interest to my little story.

I wonder if it may be possible to find out if anybody has such a photograph they may care to lend me, with permission to reproduce.

Gloucester. L. J. GUDGEON BAYLISS,
Sqn. Ldr., R.A.F. (Retd.).

History in Malta

I AM an executive member in the local club for youths and children. This year we are going to hold an exhibition in order to raise some funds. Most of our young members are air-minded, and knowing well how keen I am on aeroplanes, they have asked me to present a project called "Aeroplanes through the ages."

Can you please print this letter in your magazine so that any person willing to help will send me any models, sketches or literature?

4 Lazzarus Street, Cospicua, Malta. A. M. FALZON.

Advantages of Fluorescent Paint

WE were interested to see in the Commercial Aviation Affairs section of your February 27 issue that fluorescent markings on aircraft are intended to "catch the eye rather than to increase the distance at which they can be seen."

Your readers may be interested to know that extensive tests carried out by a number of Government Departments, as well as actual aircraft users, have proved that fluorescent colours can be seen from approximately four times the distance from which ordinary colours are discernible. This means that fast-flying aircraft coming towards each other will have that much more time to take avoiding action to reduce the risk of collision. Another advantage of fluorescent colours which has not been greatly publicized is of course that they speed rescue operations after air crashes as, especially in bad lighting conditions, fluorescent colours can very easily be spotted from the air.

This company has recently launched its new Fluojet acrylic fluorescent paints which have withstood successful trials by British and foreign operators.

Walham Grove, London, S.W.6. PETER J. TERRY.
(Sales Director, Industrial Colours, Ltd.)

Groundabout

Superstition. John Watkins, T.A.A.'s Director of Engineering, in Europe for final acceptance of their first Friendship, tells me that in their Electras the thirteenth row of seats will actually be *numbered* 13. Now, I believe that most American airlines avoid such "unlucky" numbering; I know their hotels never have a 13th Floor, *and* I've heard of all the American passengers cancelling their bookings on a San Francisco-Sydney service when they realized the date was Friday the 13th. Of the two Corporations, B.E.A. *do* use No. 13 for a seat-row; B.O.A.C., who serve the World beyond Europe, including America, settle for 12, 12A, 14. Obvious conclusion: While the rest of the World is riddled with superstition (and all American airlines are grounded on Friday the 13th), Great Britain, Europe and Australia just don't give a damn.

*

B for Billion. In California, John Watkins heard that the last B-36 had been scrapped and recalled that, by coincidence, he was visiting Convair in 1946, in connection with T.A.A.'s 240 order, when the prototype B-36 first flew. In between, some *380* of these 180-ton bombers were built. At, say, £2 million each? That's £760 million. Then spares, fuel, air and ground crew, operational, admin. and a thousand other costs. Let's double it—£1,520 million? Probably an understatement. And it never dropped a bomb in anger. Strangely enough, that was why it was built. The Great Deterrent.

*

Little Deterrent. Seeing the recent reference here to "caltrops," Chris Elliott, aviation writer, has loaned me one of those awful things, showing that their use didn't end with horse warfare. It was one of a quantity scattered in 1943 near our East Coast by a German bomber. Local schoolboys, including young Elliott, found them useful to reserve the best seats in class!

*

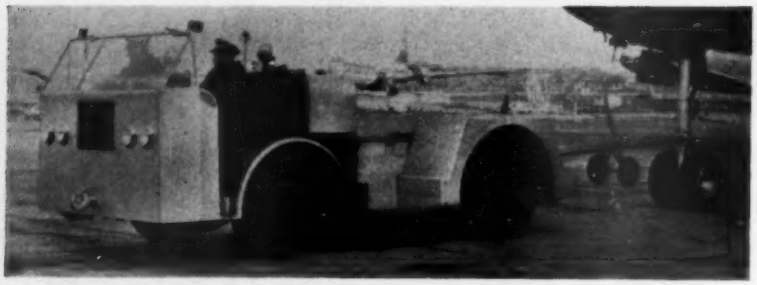
Hairways. At Silver City's Savoy reception to announce their new Manston project, my roving eye especially noted Mr. Eoin Mekie's hair. Thirteen years in the electric industry had done no more than introduce a touch of grey. Now, after eight years of commercial aviation, his hair has turned to silver. Meanwhile, Silver City, under his chairmanship, turns in the gold.

*

Drake Ducks Out. Some people, possibly with an eye on the colour—and quantity—of their hair, manage to get *out* of aviation. The latest is Harry Drake, for the last dozen years Air Correspondent for the newspaper group of the benevolent Lord Kemsley. Harry has moved to Exeter where he will free-lance as a side-line to running his own confectioner-tobacconist's shop. But he'll never get "the business" out of his blood—already he's talking of "expanding the shop's traffic potential."

by Graeme

NOTES AND EVENTS



HEAVY TOW.—The Mercury Airtug 160L, by the Mercury Truck and Tractor Co., Ltd., of Gloucester, has been adopted by B.O.A.C. to handle aircraft in the 300,000-lb.weight class. Powered by a 160-h.p. Leyland diesel engine, the Airtug itself weighs 26,000 lb. and its drawbar pull of 20,000 lb. is enough to tow a Boeing 707 against a 25-knot headwind up a 1:40 gradient.

METAL MARKING.—An electrolytic stencil etching process for marking any finished metal is being marketed in this country by Lectroetch (Gt. Britain), Ltd., of Regent House, London Rd., Portsmouth. Developed over the past 15 years and now used extensively in the U.S., this process is stated to overcome many of the problems connected with the marking of all types of metals, particularly where the stress of the metal is involved. It utilizes a specially processed stencil of high dielectric value through which an electrolite fluid contacts the parts to be marked. A current of low amperage and voltage passes through the electrolite to electrolytically dissolve out the metal in the shape of the characters of the stencil to the desired depth in a matter of seconds. This process is stated to be accomplished without stress, strain or deformation of the most delicate metallic surface.

COMET 4 SEATS. — Aerolineas Argentinas, whose first Comet 4 was delivered recently, specified D.H. lightweight seating for its first-class accommodation. These seats were designed and styled by de Havilland and built by Lancefield Aircraft Components, Ltd., of London, thus continuing an association between the two companies which started with the design and production of seats for the Dove and Heron, and continued with those for the Comet 1.

PLASTIC TOOLING.—A new range of ready-for-use materials for plastic tooling has been developed and marketed by the Kenilworth Manufacturing Co., Ltd., of West Drayton, Middx. Known under the trade name of Double Bond Toolform, these materials are stated to be especially suitable for press tools and for making the moulds used in the vacuum forming process.

R.A.F. COMMUNICATIONS. — The M.o.S., acting on behalf of the Air Ministry, has placed a contract with Marconi's Wireless Telegraph Co., Ltd., for the planning, supply and installation of a high-power radio station at the R.A.F. staging post in the Maldive Islands. In all, 14 communications transmitters and nine receivers are to be provided. The transmitting station is being built on Hitaddu, and the receiving station is sited on the island of Gan, approximately six miles away. Communication between the two islands will be effected by a duplicate Marconi Type HM 300 SHF multi-channel system.

BELGIUM SUBSIDIARY. — Simmonds Aerocessories, Ltd., a member of the Firth Cleveland Group, has announced the formation in Belgium of Simmonds Aerocessories (Belgium), S.A., as a subsidiary company. The new company has offices at 25 rue Faider and the manager is Mr. George Harms.

MICROCELL VISIT.—Mr. Harold Watkinson, the Minister of Transport and Civil Aviation, visited Microcell factories at Blackwater and Camberley recently. Among Microcell products he saw in production were chairs for high-density seating in B.O.A.C. aircraft.

Company Notices

NEW COMPANY

Suac Swiss Universal Air Charter, Ltd. (622,645).—Private co. Reg. Mar. 9. Cap. £100 in £1 shs. Subscribers (each with one sh.): H. Kennewell, C.A., 36 Knighton Rd., Leicester; Patricia J. Kennewell, Neubadrain, 21 Binninger, Basel-land, secretary. First directors to be appointed by subscribers. Solrs.: Allen and Overy, 3 Finch Lane, London, E.C.3. Reg. off.: 78-80 Cornhill, London, E.C.3.

OVERSEAS COMPANY

Emery Air Freight Corporation (F.4,771).—Particulars filed March 4, 1959, pursuant to Section 407 of the Companies Act, 1948. Cap.: Stock $400,000. Reg. in State of Delaware, U.S.A., April, 1946, to carry on a general cargo consolidation and forwarding business, by air or otherwise, etc. British address: Building No. 27, London Airport North, Hounslow, Middx. John McP. Alexander, of 64 Quaves Rd., Slough, is authorized to accept service of process and notices. Directors: John C. Emery, Leonard G. Hunt, Horatio J. Snyder and six others, all resident in U.S.A.

CHANGES OF NAME

Armstrong Siddeley Development Co., Ltd. (154,458), 18 St. James' Square, London, S.W.1. Name changed to Hawker Siddeley Aviation, Ltd., on Jan. 16, 1959.

Brush Group, Ltd. (29,533), Duke's Court, Duke St., London, S.W.1. Name changed to Hawker Siddeley Industries, Ltd., on Jan. 16, 1959.

Brush International, Ltd. (389,759), Duke's Court, Duke St., London, S.W.1. Name changed to Hawker Siddeley Brush International, Ltd., on Jan. 12, 1959.

Reactive Jet Thrust Co., Ltd. (397,449), motor and aeronautical engineers, etc., 1 Fitzroy Sq., London, W.1. Name changed to Thermoforce, Ltd., on Jan. 12, 1959.

RECEIVERSHIP (APPOINTMENT)

Aeromarine of Emsworth, Ltd. (505,698), Oranee Row, South St., Emsworth, Hants. Frederick A. J. Couldery, of 3 St. Georges Place, Brighton, 1, was appointed receiver and manager on Jan. 30, 1959, under powers contained in debenture dated April 23, 1957.

New Patent

APPLICATION ACCEPTED

812,748.—Bendix Aviation Corporation.—"Computers for determining the optimum cruising altitude of an aircraft."

Application open to public inspection on April 29, 1959; opposition period expires on July 29, 1959.

Aviation Diary

March 27-30.—Easter Gliding Rally, organized by Midland Gliding Club, at the **Long Mynd,** Salop.

April 1.—R.Ae.S. Gloucester and Cheltenham Branch, A.G.M. and film show, at the Wheatstone Hall, **Gloucester,** at 19.30 hrs.

April 1.—R.Ae.S. Brough Branch lecture, "Flying with the Trans-Antarctic Expedition," by Sqn. Ldr. J. H. Lewis, in the lecture hall, Electricity Offices, Ferensway, **Hull,** at 19.30 hrs.

April 1.—Kronfeld Club talk, "Field Landings and Retrieving," by Lorne Welch, at 74 Eccleston Square, **London,** S.W.1.

April 4.—Helic. Assn. of G.B. lecture, "Effect of Size of the Helicopter on its Economics," by R. Hafner (Bristol Aircraft) at Saunders-Roe, Ltd., **Southampton.**

April 4.—British Interplanetary Society lecture, "Some Implications of Radio Astronomy in the Fields of Navigation, Guidance and Communication," by C. M. Cade (Kelvin and Hughes) at Caxton Hall, Caxton Street, **London,** S.W.1, at 18.00 hrs.

April 7.—R.Ae.S. Bournemouth Branch lecture, "The Development of the Rotodyne," by Dr. G. S. Hislop (Fairey) in the lecture hall, A. and A.E.E., **Boscombe Down,** at 17.45 hrs.

April 7.—R.Ae.S. Luton Branch debate, in the Napier senior staff canteen, **Luton Airport,** at 18.15 hrs.

April 7.—R.Ae.S. London Airport Branch, A.G.M. and lecture, "Power from Nuclear Energy," by Dr. M. D. Wood (Ruston and Hornsby) in the lecture hall, Fairey Aviation, **Hayes,** Middx., at 18.15 hrs.

April 8.—R.Ae.S. Chester Branch lecture, "Soviet Civil Aviation," by C. Jenkins, in the lecture theatre, Grosvenor Museum, **Chester,** at 19.30 hrs.

April 8.—R.Ae.S. Weybridge Branch lecture, "The Operation of London Airport," by J. Jeffs (Commandant, L.A.P.), at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

April 8.—R.Ae.S. Graduates and Students Section lecture, "The American Aircraft Industry," by Donald W. Douglas, Jnr. (Douglas Aircraft Co.) in the library, 4 Hamilton Place, **London,** W.1, at 19.30 hrs.

April 9.—R.Ae.S. Main Lecture at Preston Branch, "The Art of Developing Aero-engines," by A. C. Lovesey (Rolls-Royce), at the Bull and Royal Hotel, **Preston,** at 19.30 hrs.

April 10.—Helic. Assn. of G.B., "French Helicopter Developments," by L. F. G. Legrand (Service Technique Aéronautique, Paris), in the R.Ae.S. Library, 4 Hamilton Place, **London,** W.1, at 18.00 hrs.

PULLIN COMPONENTS.—An illustrated pamphlet on a number of synchros, servocomponents and small motors, including a range of DC permanent magnet motors in standard synchro housings, has been published by R. B. Pullin and Co., Ltd., Phoenix Works, Great West Road, Middx.

NEW DIVISION.—The Rubery Owen Group has formed a Rowen Arc Division to manufacture under licence in Britain a new type of arc-welding equipment developed by the Westinghouse Electric Corpn., of Buffalo, New York, and known in America as West-Ing-Arc.

Birth Notices

Eaton.—On March 6, at Norfolk and Norwich Hospital, to Coups, wife of Flt. Lt. C. W. Eaton—twins, son and daughter.

Glass.—On March 11, at South Cerney, to Monica (*née* Partleton), wife of Flt. Lt. N. J. Glass—a daughter.

Jenkins.—On March 11, at the London Clinic, to Wendy (*née* Shakespear), wife of Sqn. Ldr. A. F. Jenkins—a son.

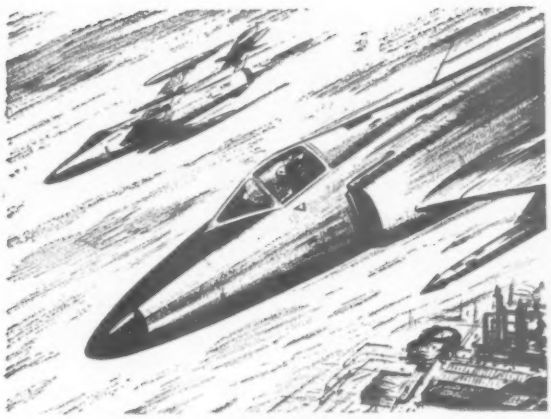
Peters.—On March 14, at Drayton, Portsmouth, to Moyra (*née* Smith), wife of Flt. Lt. E. A. Peters—a daughter.

Ransom.—On March 14, at the Roe Valley Hospital, Limavady, to José (*née* Burrough), wife of Flt. Lt. D. Ransom—a daughter.

Reed-Purvis.—On March 12, at R.A.F. Hospital, Halton, Bucks, to Betty, wife of Flt. Lt. H. Reed-Purvis—a daughter.

Senior.—On March 12, at King's Lynn Maternity Hospital, to Lyn (*née* Curtis), wife of Flt. Lt. R. Senior—a son.

Smith.—On March 7, at R.A.F. Hospital, Ely, Cambs, to Betty (*née* Maclachlan), wife of Flt. Lt. R. V. Smith, D.F.M.—a son.



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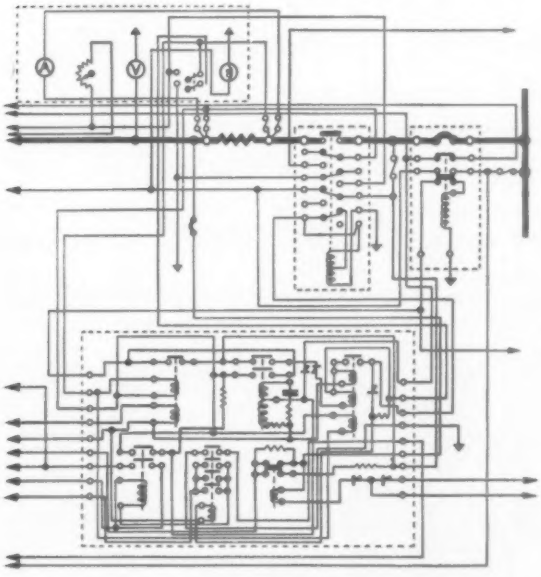

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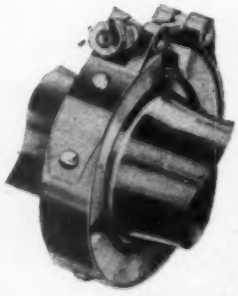

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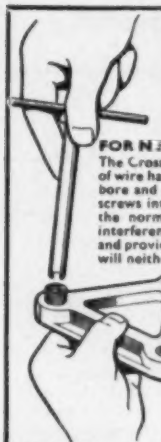

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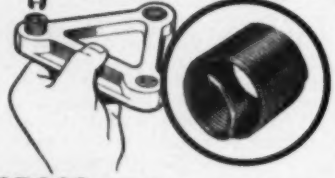

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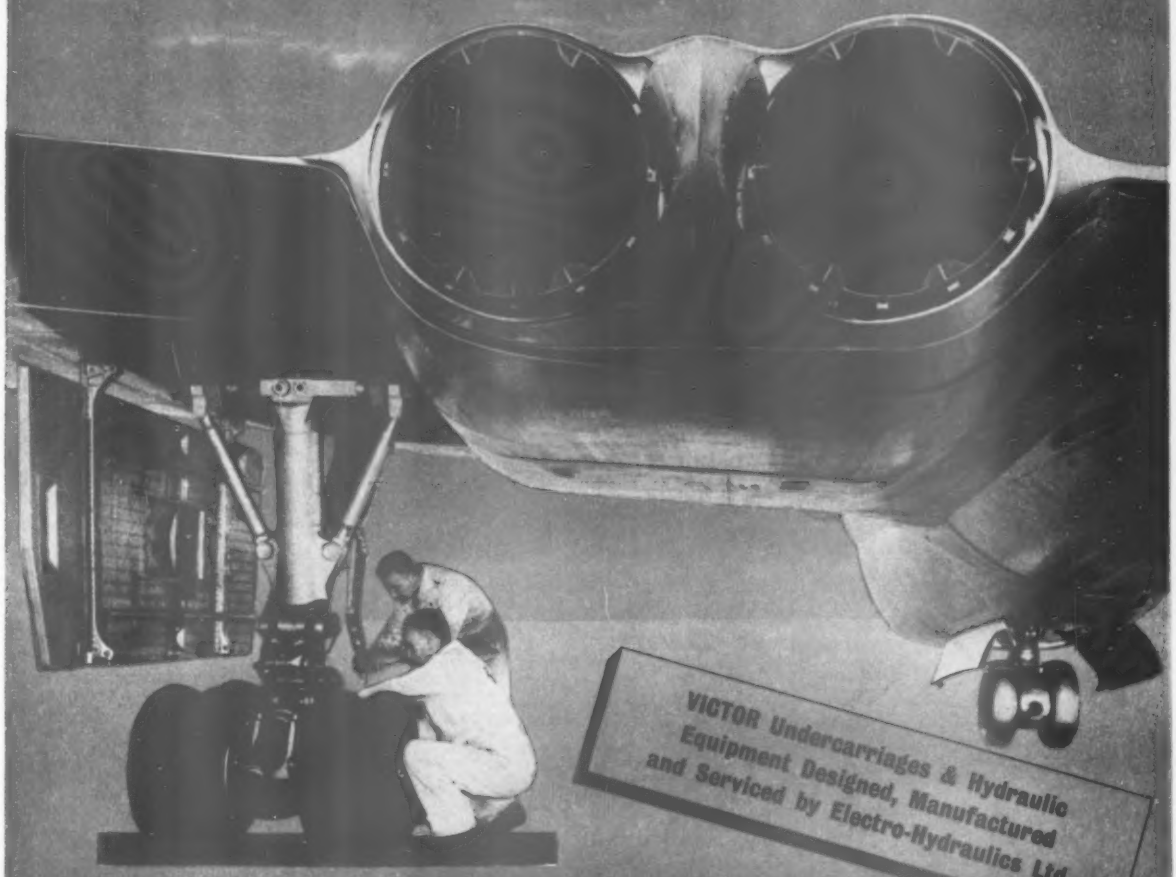

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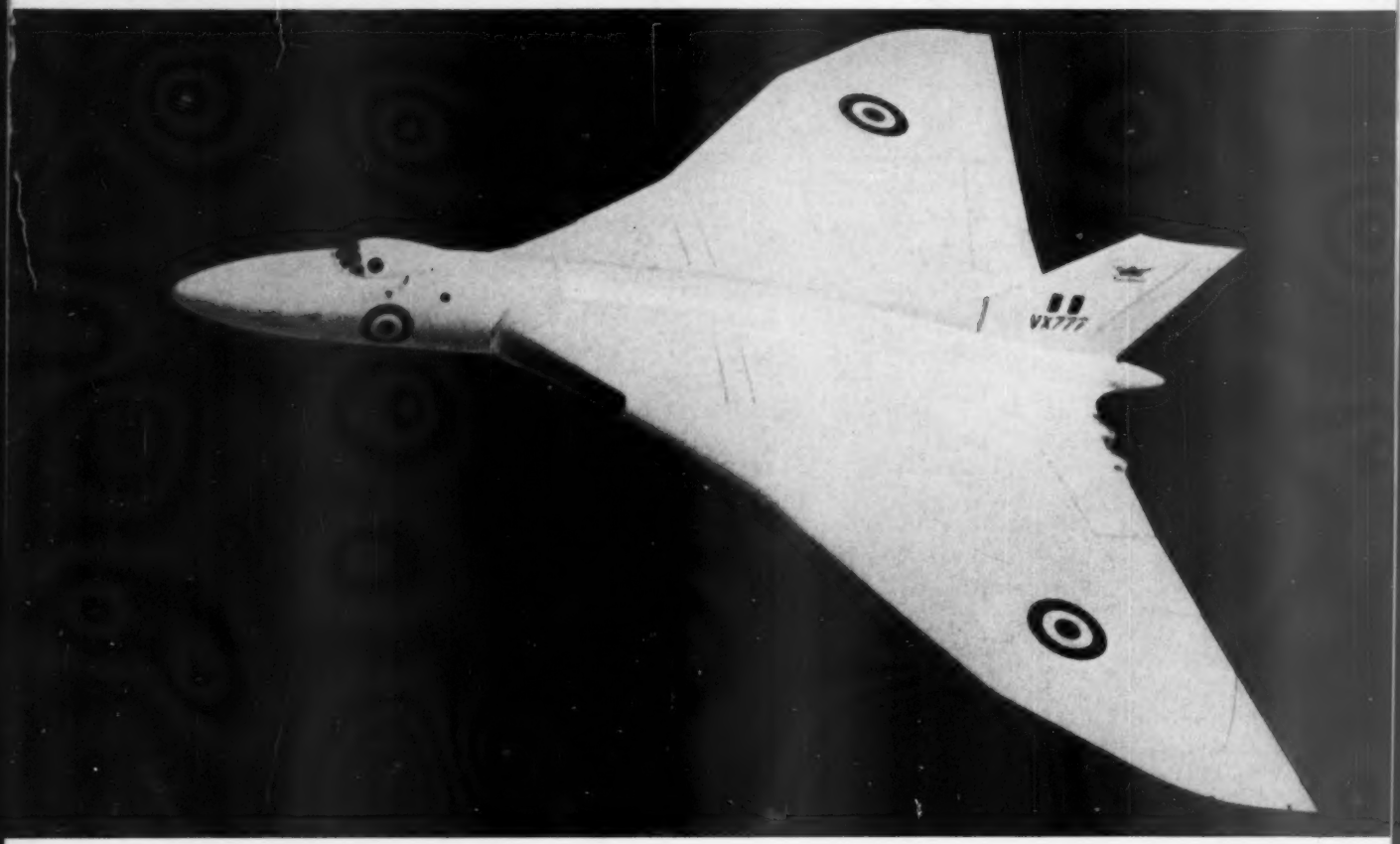

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